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The MODEL ENGINEER

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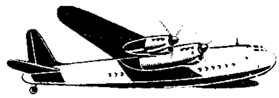


VOL. 96. NO. 2404

SMOKE RINGS

Our Cover Picture

THE extraordinary photograph from which this weeks' cover illustration has been prepared was taken by Mr. Oscar Marcus, of Edinburgh, who was riding on the footplate of the "Flying Scotsman." Such a scene is, of course, familiar to any engineman and to not a few privileged holders of footplate passes; but we wonder how many of either have managed to secure so accurate a rendering of the phrase: "As the Driver sees it." The engine seen coming the opposite way is the *Windsor Lad*, a well-known Gresley Pacific.

A Notable Science Museum Display

THIS year the Institution of Mechanical Engineers is celebrating the centenary of its foundation in 1847 with George Stephenson as its first President. To link up with this notable occasion the Science Museum at South Kensington has arranged a special exhibition of mechanical engineering in all its branches, covering a century of development. This exhibition is divided into several sections, including mechanical plant for power stations; locomotives; automobile, marine and aero-engines; hydraulic and handling machinery, etc. Important historical objects are shown in their appropriate galleries. Modern exhibits are displayed in Gallery 1, where the sections correspond with the subjects discussed during the Conference at the Institution's Headquarters during June. Scale models made specially for this exhibition include the steam turbines of the R.M.S. *Queen Elizabeth* and a Southern Railway "West Country" steam locomotive. Most exhibits, such as automobile and aero-engines, models of high-pressure boilers, steam and gas turbines, have never been shown in the Science Museum before. Thus, the National Museum of Science and Industry links the general public with various scientific and technical institutions. This new exhibition shows that modern civilisation is largely dependent for power, machinery and transport on the profession of the mechanical engineer, whose skill is needed at some stage in almost every industry. The exhibition will remain on view till August 24th daily, admission free, from 10 a.m. to 6 p.m. on weekdays, including Saturdays and Bank Holiday, and from 2.30 p.m. to 6 p.m. on Sundays.

A Dudley Society

A NEW Society for Dudley and District formed early this year, is getting on its feet quite nicely according to a letter from the Hon. Secretary, Frank G. M. Wallace, of 9, Ednam Road, Dudley. The President is Mr. F. G. Cozens, Managing-Director of Wilmot Trucks Ltd., and several other local notabilities have accepted office in various capacities to help in the establishment of the Society on a sound basis. The Society will cater for all branches of model making interest, and if enthusiasm is any guide, a successful career is ensured. It has my best wishes.

The Passing of the Steam-Roller

I HAVE been interested to read in *The Times* of June 3rd, a charmingly-written leading article lamenting the passing of the steam-roller, as instanced by the fact that the Paddington Borough Council's two 26-year-old steam-rollers are to be replaced by rollers of the modern Diesel-type. We have, of course, anticipated this change in THE MODEL ENGINEER by the design we published for building a model of the Aveling-Barford I.C.-engined roller, some excellent examples of which, from our drawings, were shown at our 1946 Exhibition. *The Times* says :—" There is nothing subtle about a steam-roller or the images connected with it, but there is no denying, either, the extreme effectiveness, the inevitability, associated with its movements and intentions." The word steam-roller has been used in many connections to imply crushing power, but to the mind of the engineer, and of the model engineer, it conveys the thought of a self-contained majestic machine, slow-moving, perhaps, but immediately responsive to the touch of the driver's hand on the regulator or the steering-wheel and a most impressive exponent of the power of steam. Although there are many I.C. rollers now on the road, steam as a motive power, will not disappear immediately, and I have no doubt the surviving examples of the steam era, wherever they may be met, will be regarded with increased interest and perhaps concealed regret at their impending fate. It is up to model engineers to preserve the memory of these giants of the road by their admirable and faithful models.

Those Odd Jobs

THERE must be many model engineers whose programme of serious model-making is interrupted by calls upon their skill and good neighbourship from friends who have some of those little odd jobs which require workshop attention. True as this is of MODEL ENGINEER readers in the home country, I can well imagine that it is even more generally the case in remote districts overseas. This is confirmed in the course of a welcome letter from an old friend, Mr. T. M. Ellis, of Cromwell, New Zealand, who thus outlines the little jobs he has done and those he hopes to do. He writes :—" My workshop has been neglected for some years I am afraid, with the exception that I have been called upon to do all sorts of jobs for other people. Mending reading glasses (frames thereof), cutting small gears for recording apparatus, making nipples for Primus blow-lamps, cutting splines in small shafting, mending camp-stoves and endless other jobs. This winter I hope to make a *wood-turning* lathe (rather a fall from grace, I suppose), a power hack-saw, and a pair of proportional dividers—illustrated in THE MODEL ENGINEER of November 17th, 1921. Yes, I have quite a large collection of back numbers with a few gaps, which I hope some day to fill. What a mine of information those back numbers are, too. Seldom am I disappointed in my search for information. By the way, a circular-saw bench and a model T.B.D. are also on the list (but not, of course, for this winter), and various other gadgets. When is one's workshop actually complete ? I suppose the fact that it never really does become complete, keeps the interest up. There are several fellows in our little town who are interested ; I call them my pupils, and we get together fairly regularly and have a discussion on various matters of interest—tools, gadgets, lathes, etc. One of them is building a 3½-in. gauge locomotive, and is at the same time making various attachments for his lathe. Two of us are members of the Otago Model Engineering Society, whose headquarters are in Dunedin, and whenever we go down there (150 miles from here) we are taken round to the various workshops, and my experience is that almost everywhere one goes, there is a little bit of scrap put aside for me to bring home. (We are not quite so able to provide ourselves with scrap up here.)" I wonder how far Mr. Ellis will get with his programme of future work while those odd jobs still come along. Anyway, he seems to be a cheerful victim, and I am sure his workshop is a happy spot in his busy life.

Oxford Model Engineers

I AM pleased to hear that the Oxford Society has been making good progress and that arrangements are now being made to obtain carpenter's benches and wood-working tools to add to the completion of the workshop. This will be good news for those interested in model-boat building and ship-modelling of all kinds, a section of which it is intended to develop more energetically in the future. So far locomotive and traction-engine interests have rather monopolised the field ; now boat enthusiasts are to have their chance of practical encouragement. One of the members, Mr. H. Tolley, will be remembered by our pre-war Exhibition visitors for his fine model of a 2½-in. gauge G.W.R. *King George V*, which put him well into the prize list. I am sorry to hear that he is now completely confined to his invalid chair, and unable to enjoy a ride behind his locomotive. I send him our kindest thoughts in his disablement. Ship and boat modellers in the Oxford area are sure of a helpful welcome from the Assistant Secretary, K. W. G. Taylor, 10, Langley Close, Headington, Oxford.

A Cornwall Exhibition

NEWS comes to hand of an Exhibition of models to be held at the Polytechnic Hall, Falmouth, under the auspices of the Royal Cornwall Polytechnic Society. The classes cover all branches of model making and handicrafts. Special prizes are being offered by Lord Seaton for the two best exhibits, and there are other prizes offered by private donors, as well as the possibility of awards by the Royal Cornwall Polytechnic Society for original work. It is a pity that the date, 16th August to 30th, will clash with the Model Engineer Exhibition in London, but the show will no doubt be of much interest to local enthusiasts. Full information may be obtained from the Secretary, E. J. Moseley, at the Society's offices at Falmouth.

Percival Marshall

Notes on Noah's Ark

With special reference to the competition for the best model of the "Ark" submitted for the Shipwright's Exhibition

by "Jason"

IT is customary for the Prime Warden of the Worshipful Company of Shipwrights at the conclusion of his year of office to express his gratitude for the honour in some benevolent or other manner.

The manner chosen by the Prime Warden, George Wigham Richardson, was unique as well as benevolent, and of service to the craftsmanship of shipbuilding. He opened a competition among craftsmen and apprentices in shipbuilding yards and aircraft works for the best model of Noah's Ark. It must be emphasised that the idea was to encourage craftsmanship. The conditions were few and somewhat elastic. Valuable prizes were offered. The competition was open to individuals or teams, but the work had to be under the blessing and perhaps patronage of the competitors' employers, because materials and advice could be given and accepted. Books and tools could be loaned and presumably both time and premises were also available.

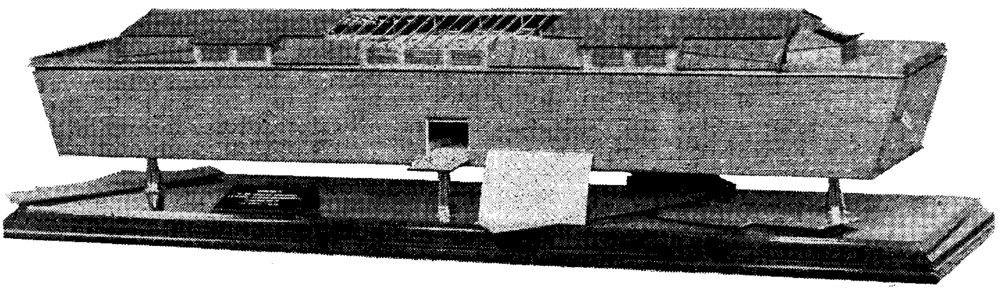


Photo by] [*Craine*
The First-Prize winning entry in the competition for the best model of Noah's Ark. *Part of the roof is removed to show internal arrangements. The* Ark *was a three-storey structure, two below and one above the main deck. Model by team (Messrs. Ash, McBride and Warman) from Messrs J. Samuel White* & *Co. Ltd., of Cowes*

These teams may be regarded as amateur ship modellers. The results were really amazing in several directions. There were eighteen entries, all of them to an exceedingly high standard of craftsmanship. But there were hardly any two alike, for, as it stated in rule 12, "*As so little is known of the design of 'The Ark,' it has been decided to give the widest discretion in this matter to the craftsmen themselves, but, for the sake of uniformity* a few details were laid down concerning limits of size, well seasoned wood, option of solid, laminated or timbered and planked hull; and it was left to the individual artists' taste to decide about the top storey or deck-house, together with the inclusion of the window. All competitors were advised to read *Genesis*: *Chapters vi and vii.*

All models, therefore, were 48 in. long, 4.8 in. deep from main-deck to the keel, and 8 in. beam. They were all mounted on their baseboards, but from that point onwards all similarity ceased. The winning model became the property of the Company of Shipwrights, and it is not without interest to remark that the Worshipful Company's coat of arms is surmounted by an Ark, and the motto is: *Within the Ark, Safe for ever.*

Now the questions arise, What is known of the Ark? Will there be any danger that the prizewinning entry may, in future, be looked upon as a model which bears the stamp of authenticity and is approved by such an august body as the Company of Shipwrights?

I sought the answers in an interview with Mr. George Wigham Richardson himself. When I explained the nature of my questions, Mr. Richardson made it quite clear that his objective in this competition was the encouragement of craftsmanship among the young workers in the shipyards and the aircraft factories. The selection of Noah's Ark as a prototype will be obvious. The examination of the entries showed that this objective had been amply satisfied. Indeed, not only the judges, but the committee and the whole company have been very impressed with the high standards achieved by the competitors. Moreover, the entries came from every corner of the country from shipyards and aircraft factories alike. It augured well for the future of shipwrightry. Then Mr. Richardson and I settled down to an informal discussion and I was indeed surprised that such a busy man had found time to study the legends of the Flood and the building of Noah's Ark. We agreed on many points and even in the field of speculation we found much in common. I feel sure that ship modeller readers will join me in an expression of thanks to Mr. Wigham Richardson, firstly for his general interest in the modelling of ships and secondly, for sparing so much of his valuable time in an

interview about the competition for the best model of a Noah's Ark. There is just one item of interest worth a special mention. I did say that the popular choice among the eighteen entries seemed to be that model which looked like a log cabin because it was built of logs. He was not surprised but said it had been considered, of course, but, on purely technical grounds, it was rejected because it would not have floated upright. The judges were men of distinction, fully qualified to examine from all aspects. I find myself in complete agreement with the judges, who, by the way, did not include Mr. Wigham Richardson. Let us now look at this matter of *Noah's Ark*.

It was formerly thought as indicated in many issues of the Bible, that the Flood could be dated about 2450 B.C., that is about 4,400 years ago. Recent excavations at Ur, however, show that a very heavy flood occurred about 4600 B.C. (6,500 years ago). There is ample evidence to show that the locality, i.e. the junction of the Tigris and Euphrates, was periodically subject to floods. Many of the Middle Eastern Empires have legends about the Flood and many students today are of the opinion that the Hebrew version of Noah is a mixture of the Hebrew narrative of the mythological race of giants (both in stature and longevity) and one of the Babylonian Flood legends. It is also thought that the early Hebrew writers found it difficult to "marry" the two stories together in time and space. There is agreement on one point. The central figure in each of the Flood legends built a boat of some sort and a large boat at that, on, or in which, he saved his family, livestock, and possessions. It can be accepted, therefore, that floods were expected from time to time in the Chaldean Plain. Wisdom and intelligence might even foresee an extra heavy flood. The main causes may be summarised: (1) Heavy snows in Anatolia and the Caucasus; (2) Very strong south-west monsoon which produced heavy rains.

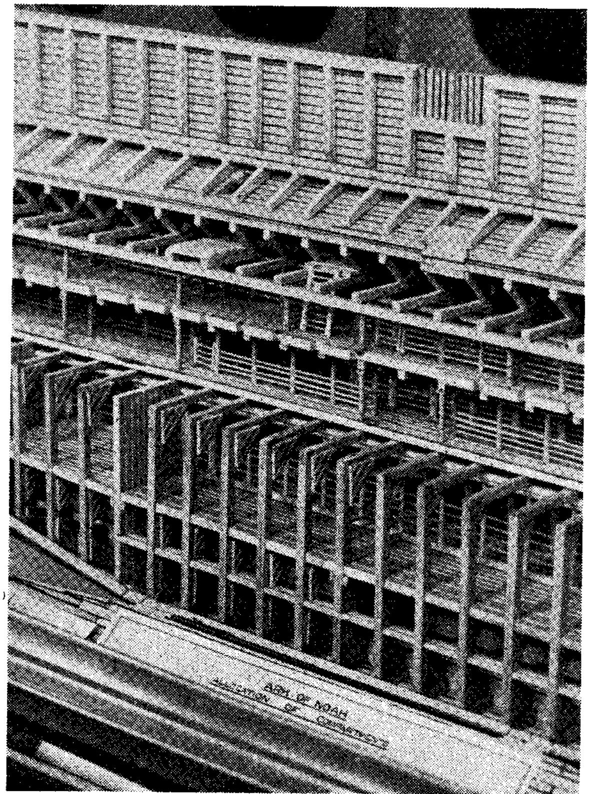


Photo by] [*Craine*

Winner of Second Prize, model of Noah's Ark *Competition. View shows interior arrangements (with roof folded back). The competition was a test of craftsmanship. Team: Messrs. Browning, Mowatt and Hart, from Fairfield Shipbuilding and Engineering Co. Ltd., Govan, Glasgow*

Meteorological conditions in Mesopotamia and the valleys of the Euphrates and Tigris differed 5,000 years ago from those existing today. Grassland differs from forestry country in its effects upon temperatures and humidity and the difference is even more pronounced in desert or parched country. It follows from these that the idea of building a boat as an insurance against loss by flood, of life, livestock, goods, and chattels, was a distinct possibility. There remains the problem: what sort of a boat? Here we are on easier ground. All boat-builders, even Noah and the Babylonians of the several Flood legends, usually build to a purpose, or if you like, designed for the particular set of conditions to be encountered.

They Were not Going Anywhere

No propulsion was needed. If possible they would like to remain on their own ground. Therefore, nothing more elaborate than a raft was needed. A big raft, of course sufficient to form a foundation for houses, stables and barns for a large farm. Nor was comfort to be unduly emphasised, but rather the question of safety.

Well, rafts were in use in many places at the dawn dawn of history, say 4000 to 5000 B.C., certainly in Egypt, the Black Sea rivers and on the Tigris and Euphrates themselves. These rafts were lashed together, manned by crews and, under at least partial control, were floated down the rivers for house building and other purposes.

It may be argued that Noah built a boat; a properly built-up affair. Why should he? Even so, a reason being given then what sort and size of a boat. The dimensions given in the Bible are four hundred and fifty feet long accepting a cubit as being 18 in. (elbow to finger tip).

Britain's best boat at the time of the flood was something akin to the Brigg Boat, a dugout of 50 ft. North-western Europe, say in Scandinavia, might have managed a five plank boat of a similar length. The Don and Volga basins were in about the same state of development.

The Minoans and Egyptians who had developed stitching, dowelling, and the hogback stringer, had attained a length of perhaps one hundred and fifty feet, with a beam of twenty-five or thirty feet. It must be emphasized that Northern shipbuilding consisted of single length planks, whereas Africa and Asia (even to the East Indies) were joining pieces of wood ten feet long in carvel-built boats even as they do today. There are two other types which should be examined as possible "Arks." The skin covered crates or coracle type of boat and the raft reinforced with skins for buoyancy purposes.

Irish coracles of the curragh type were developed up to the "five-hide boat," say about 40 ft. in length. The Esquimaux also developed their umiaks to a similar size. Indeed, the umiaks and the curraghs have much in common. But 40 ft. is far short of 450 ft.

That leaves us with the raft. There is no practical limit to the size of a raft if it is for use in still water or at any rate waters free of "seas" and "rollers." Heavy rain is the sailor's best friend, for the rain flattens out any waves. In such circumstances an elaborate raft could be made. The craft was pitched inside and outside. There is plenty of pitch even today, and it is still used for boats. Presumably some form of caulking was used. The English *Brigg Boat*, of say, 3000 B.C., was caulked with mosses, and so were the early Scandinavian boats. Animal hair has been in general use over wide localities for thousands of years as part of a caulking mixture. Thus we have a floating structure which will not have to stand the buffeting of large waves nor force its way through water at any speed. These two items are the factors against which naval architects have to pit themselves. The third factor, that of grounding, would not arise in the case of the "Ark." Once aground the voyage was finished. There is no mention of an anchor. One might perhaps expect something very unusual to happen if Noah had anchored. The bow would have remained but perhaps amidships and aft might have floated away. The Biblical version says that the land was covered to a depth of 25 or 30 ft., presumably above the normal land heights.

Perhaps we might endeavour to trace the voyage of the "Ark." The *Genesis* version confines itself to six weeks heavy rain (south-west monsoon and rainy season) and also to exceptionally high tides (fountains of the deep) probably caused by the south-west monsoon extending its northerly limits. The combined effects of these would tend to leave the flood waters static with the monsoon having a phenomenal extension to the north, even if only a light to moderate breeze. We can, however, dismiss the statement about the "Ark" coming to rest on Mount Ararat as a mistranslation. It would be quite fair to say that the "Ark" drifted and was blown upstream *towards* Mount Ararat, for that is the source of the Euphrates. Although Noah's "Ark" was afloat about five months, it is doubtful if the landing was a hundred miles from the point of departure.

Now the mention of five months directs attention to the organisation behind the "Ark's" voyage; the provision for fodder and food, I nearly said water as well, but a bucket overboard would solve that. We may dismiss the idea of elephants, giraffes, lions, etc., as being in the "Ark." The livestock would be that usually found on any large farm. The loss of life and property would be very heavy for the area of the Flood was probably 400 or 500 miles long and maybe 200 miles wide. Still, Noah would have to provide fodder and food until the garnering of the following harvest, and that is what is meant by organisation.

One thought kept obtruding itself upon me and that was the question of ventilation. None of the competitors made provision for it. Some did not even include the window. A Hebrew scholar friend of mine some years ago assisted me when I was trying to establish some details of the window. I was then working on a history of portholes. The window was formed of *a stone which let in light.* My collaborator defined this stone as onyx or jade; for glass was unknown, except possibly as small beads.

There has, of course, been much speculation on the building of the "Ark."

We are, however, on sure ground for some of the elements of the story of Noah.

(1) There was a Flood (confirmed by recent excavations at Ur of the Chaldees in the past dozen years) date 4600 B.C. (6,500 years ago).
(2) There are half-a-dozen or more legends from different nations telling of the man who built a boat to save his family and livestock, probably a Babylonian or a Chaldean.
(3) The Biblical measurements probably refer to a raft if they are correct. Not until the nineteenth century did the naval architect build a wooden ship 300 ft. long. The 450 ft. of the "Ark" has not been attained, and certainly never exceeded.

Notwithstanding, the building of the "Ark" was a wonderful example of foresight, planning, and building.

Activity at Huddersfield

At the annual general meeting of the Huddersfield Society, a new president, a new secretary, and a new committee were elected.

The committee met recently and decided on the following programme :—

(1) Development of the site at Highfields as the centre of the Society, eventually to have a hut or room, a locomotive track and the boat-pond. The first jobs to be done are clearing the site, fencing it in and providing a shelter. Anderson shelters have been purchased and fencing materials are on the site. Work on the site will be carried out every Sunday at 10 a.m., Thursdays 7 p.m., and Saturdays 2.30 p.m.

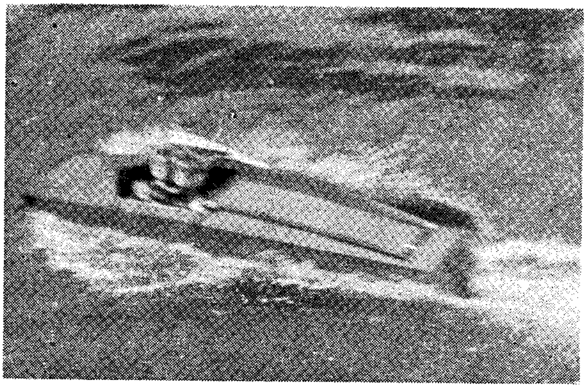
Two committee men will be in attendance at each of the above times.

(2) *Holidays at Home.*—We shall be running a locomotive track during this period.

Hon. Secretary: F. W. L. BOTTOMLEY, 763, Manchester Road, Huddersfield.

"POND WARMING" AT BROCKWELL PARK

IN the "good old days" before the war, the pond at Brockwell Park, London, S.W., was a happy hunting ground for model power-boat enthusiasts on practically every Sunday morning throughout most of the year. During the war, however, the pond area was closed, and it is only within the last few weeks that it has been possible to get it re-opened and made suitable for the running of model power-boats. The old South London Power Boat Club is now merged with the South London Model Engineering Society, and several of the pre-war members, together with a number of newcomers, took part in an informal meeting held on Sunday, May the 18th.

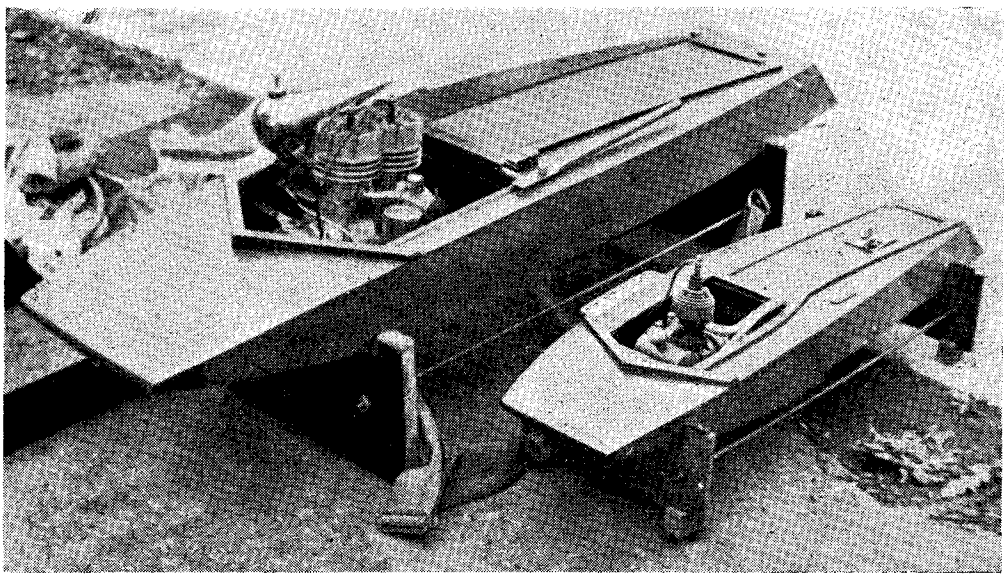


Mr. Phillips's 30-c.c. speed-boat under way

No competitions were held at this meeting, but there was plenty of running of both speed and prototype craft, and the spirit of the old days was effectively renewed. Among the veteran speed craft, Mr. Parris's *Wasp III*, the winner of many past events, gave a display which showed that neither its performance nor reliability have fallen off, despite its long and arduous career. An interesting new boat, Mr. Phillips' *Mabs II*, fiitted with a twin air-cooled two-stroke of 30 c.c., made several runs with steadily improving performances as the adjustments were mastered. Another boat by Mr. Philips is fitted with a $3\frac{1}{2}$-c.c. two-stroke, and is built to the design of the "M.E." 24-in. hydroplane hull; the larger boat is also based on the same d sign, suitably enlarged.

Another interesting boat in the speed class was the flash steamer *Blitz II*, which, after some teething trouble in which it did its best to live up to its name, by indulging in several ominous explosions and fire down below, succeeded in making a couple of runs at quite a promising speed.

The prototype craft included a new petrol-



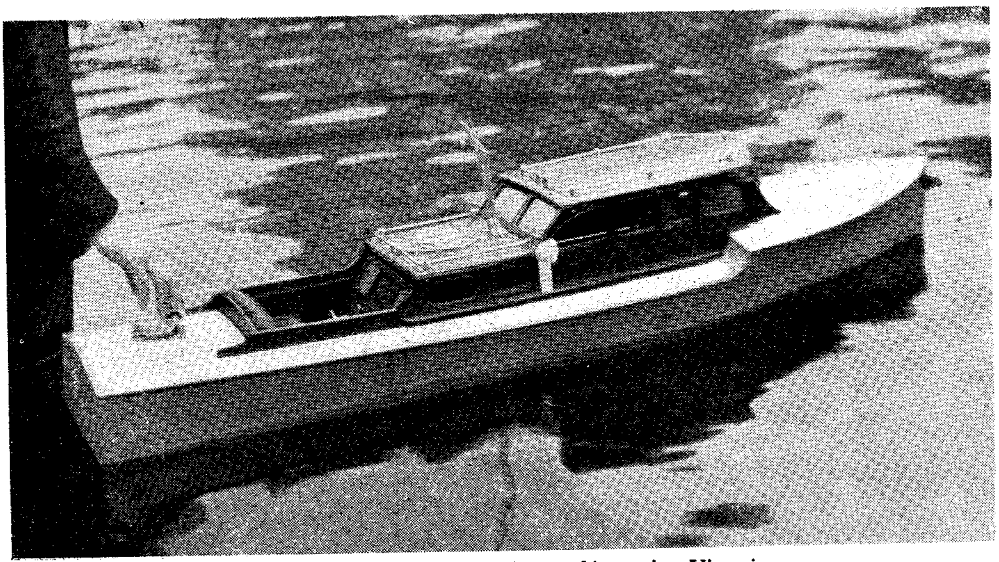
The 30-c.c. and $3\frac{1}{2}$-c.c. speed-boats by Mr. Phillips

Mr. Whiting's 30-c.c. cabin-cruiser crossing the pond

Mr. Phillips adjusting his 30-c.c. twin two-stroke

driven cabin cruiser by Mr. Griffin, fitted with a 30-c.c. side-valve Hallam engine, and another by Mr. Whiting, in which a 30-c.c. "E.M." two-stroke was installed. Both these boats put up good runs at a speed which is quite high enough for comfortable handling.

Model power boat enthusiasts in the South London area will welcome the news that Brockwell Park pond is again available, and in its present condition is one of the best model power boat sailing waters in the locality. Enquiries regarding meetings at the pond, or any matters connected with the South London Model Engineering Society, should be addressed to the Hon. Sec., W. R. Cook, 103, Engleheart Road, Catford, London, S.E.6.



Mr. Griffin's petrol-driven cabin-cruiser Victoria

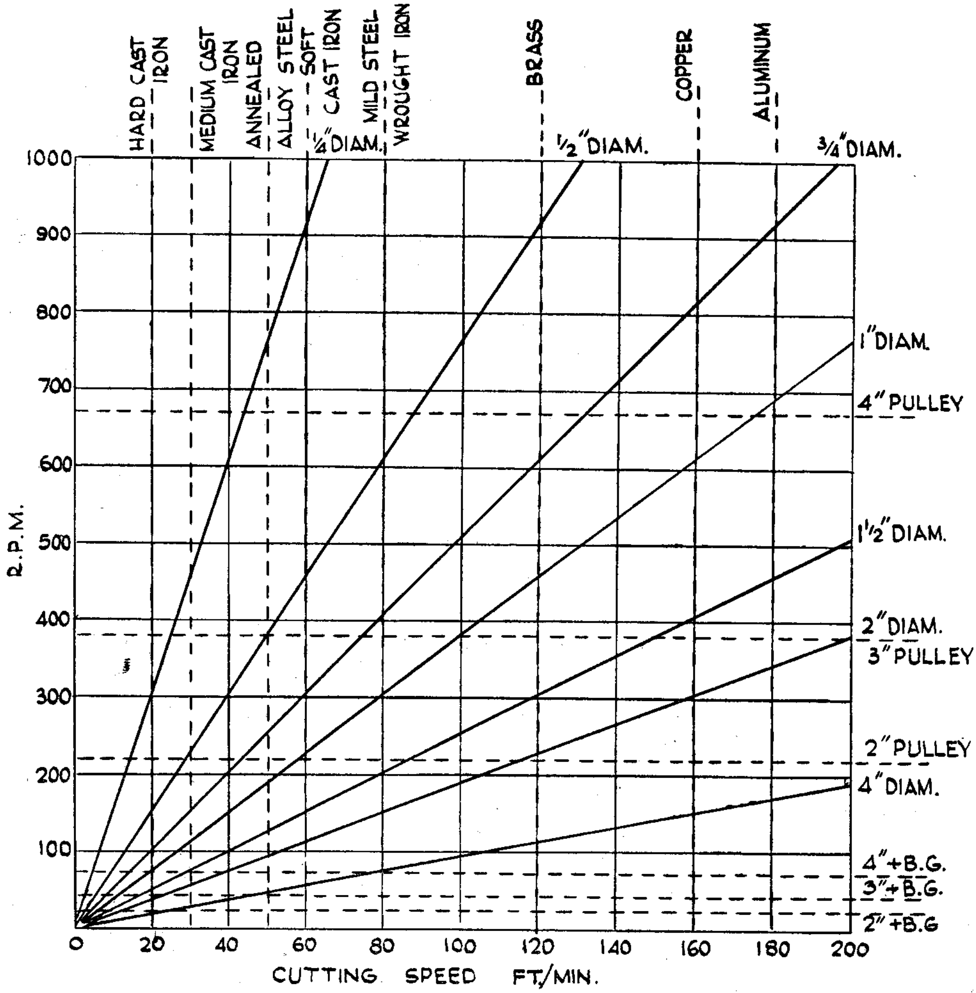
A HANDY REFERENCE CHART FOR THE LATHE

by K. J. Easton, A.M.I.E.E.

ONE of the first things the inexperienced lathe-user learns, from what often proves to be costly experience, is the importance of using the correct cutting speed. The determination of the correct speed for any particular job, and the set-up on the lathe to give it, become in time largely a matter of habit, but until the habit is acquired it is handy to have a quick reference which may frequently save both time and tedious calculations. The chart illustrated was constructed for this purpose, for use with a Portass $3\frac{1}{8}$-in. B.G.S.C. lathe.

Since for any given diameter of work the peripheral speed (in ft./min.) is directly proportional to radial speed (in revs./min.), a straight line through the origin of the two scales will give the relation between the two.

To construct the chart calculate the cutting speed for some convenient value of radial speed from the expression :—



Cutting speed = r.p.m. × 0.262D where D = diameter of work in inches.

This point is plotted on the chart and joined by a straight line to the origin. Repeat the process for other suitable diameters. It is not necessary to crowd the chart with lines, since the cutting speed, being directly proportional to diameter,

(*Continued on page* 739)

*WHY NOT A MODEL ROTARY?

by Edgar T. Westbury

IN all types of Gnome engines, the cams and timing gear were fairly straightforward, separate cams being used for each exhaust valve, operating through roller tappets, which were arranged in spiral formation around the cam casing, so that each lined up with its own cam, as shown in Fig. 3. The cams were attached to a sleeve running freely on the stationary " maneton " shaft, together with their spur gear, and driven by planetary gears mounted on studs in the rotating cam casing, from a stationary pinion on the shaft. This assembly was fitted at the front end of the engine, behind the propeller boss.

Other types of rotary engines, introduced subsequently to the Gnome, had much more complicated valve actuating machanism, in many cases having all the exhaust or inlet tappets operated in series by a single set of cams, which were not driven at the usual ratio of 2 to 1, but by differential movement produced by the meshing of quite unorthodox internal and external gearing. Some of the mechanisms used were extremely ingenious, and would well repay study by those who revel in mechanical problems and paradoxes. My experience extended to three other makes of engines ; the Le Rhone, Clerget,

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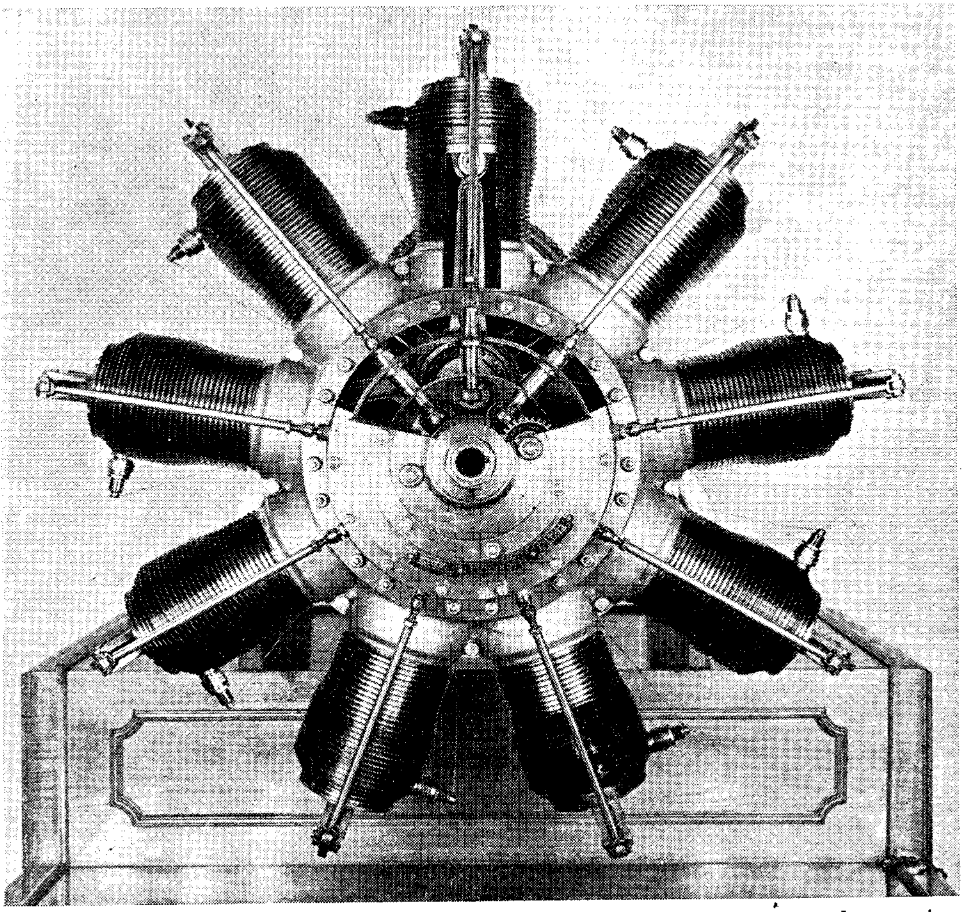
* *Continued from page 682, " M.E.," June 5, 1947.*



100 *h.p. Gnome-Monosoupape engine* (1913) *with part of timing-case cut away to show gearing, cams and roller tappets.*
(Crown copyright. From an exhibit in the Science Museum, South Kensington)

and Bentley—the latter being the largest type put into service, producing 225 h.p., and installed in the Sopwith "Snipe" and other "super" aircraft of the period.

To the best of my recollection, all these engines had separate inlet and exhaust valves, and the inlet valves were fitted with inlet pipes to transfer the mixture from the crankcase. In one case, both valves were operated by a double-ended beam rocker by a push-pull rod actuated by a double row of "give-and-take" cams. The Bentley, I believe, had quite orthodox push-rods to each valve, the inlet and exhaust valves being operated from separate cam rings.

Carburation was extremely crude on all types of rotary engines. The original Gnome, and some later types of engines, had a device not unlike the simple suction carburettors used on most model two-strokes nowadays — namely, a plain jet in a choke tube, with or without an air control; the jets were fed by gravity or pressure, without float feed. An improvement on this type was the Bloctube carburettor, which had a "sluice-gate" type of throttle, with a tapered needle attached to it to modulate the jet area, thus providing a primitive form of mechanical compensation. The Monosoupape engine had a controllable injection pump which fed fuel directly to the crankcase. But in none of these devices was there any great flexibility of control—I believe the last-mentioned engine had an effective speed range from about 1,200 to 1,800 r.p.m.

Ignition was effected by one, or sometimes two magnetos (virtually of the single cylinder type, except that they produced two sparks per revolution), mounted on the stationary framing at the back of the engine, and geared to the rotating crankcase in a ratio depending on the number of cylinders. Thus a nine-cylinder engine would have the magneto geared $2\frac{1}{4}$ to 1 up, so as to produce nine sparks in two engine revolutions. A fibre ring attached to the crankcase acted as a distributor, and connection to the plugs was often made with bare wires, stretched tightly from the distributor segments to the plugs.

Lubrication usually consisted of pumping measured quantities of oil into the crankcase by a geared-down plunger pump. It is well known that rotaries consumed almost as much oil as petrol, and the only oil suitable at the time was pure castor oil, so that what with the open exhausts and the whirling cylinders, the entire aircraft, including the pilot, quickly became coated with an incredibly tenacious film of oil, which in turn became an efficient collector of dust, flies, and other miscellaneous trifles. Moreover, there were many standing jokes about the medicinal and metabolic effects of flying behind a rotary.

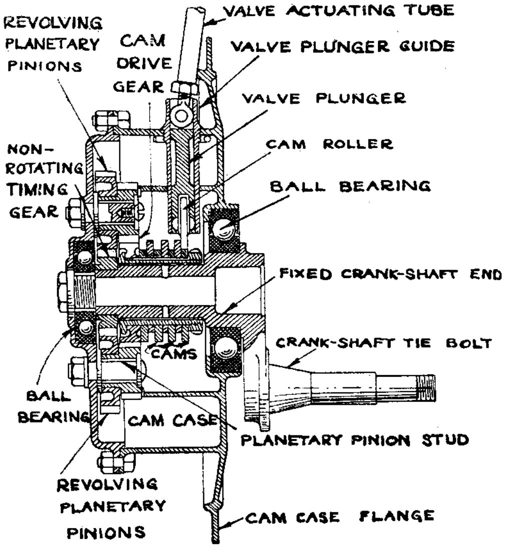


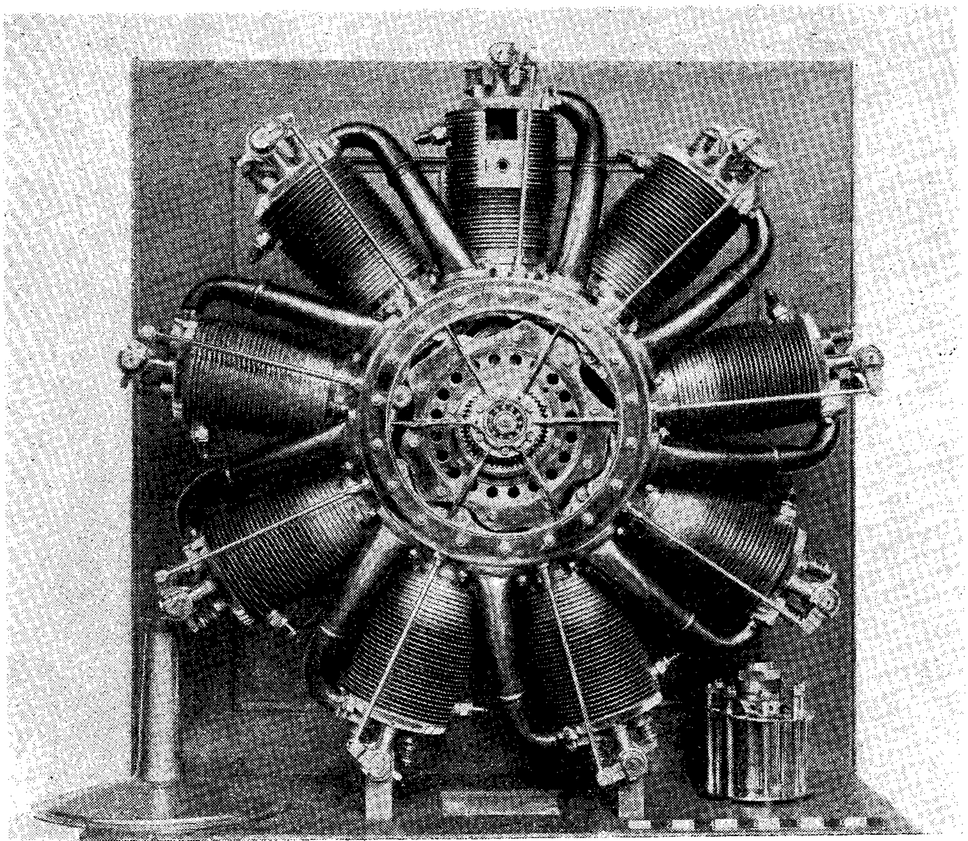
Fig. 3. Section of monosoupape timing gear case, showing cam sleeve, planetary pinions, and gear-wheel fixed to stationary maneton shaft.

Most of the other mechanical details of the rotary engines are fairly well understood, and some of them have been inherited and perpetuated in modern radial engines; as, for instance, the system of connecting rods, with one master rod having all the other rods articulated to it as used in the Gnome engines. Incidentally, this method, although the best from the purely mechanical point of view, entails a variation in the timing of the pistons which may be troublesome in certain circumstances. In one of the early rotaries, the big-end bearings consisted of concentric annular rings in which engaged segmental shoes formed on the ends of the connecting rods.

The obturateur piston ring which featured in the design of the Gnome engines might be described as a kind of metallic "cup leather," which used the gas pressure to expand the flexible edge of the ring against the cylinder wall. While it was undoubtedly effective in maintaining compression, despite cylinder inaccuracy and distortion, it probably caused abnormal friction; at any rate its merit has not justified its survival.

It may be mentioned that there were one or two attempts to produce two-stroke rotary engines, and in at least one case, there is reason to believe that some practical success was attained. The principles of the Monosoupape engine, which I have seen fallaciously, or at any rate loosely, described as a "cross between a two-stroke and a four-stroke," has been applied to small single stationary-cylinder engines, with the idea of simplifying and cheapening construction.

Whatever may be the attractions of the rotary-cylinder type of engine as a subject for actual construction by model engineers, there is no doubt about its interest, and I believe that the ingenuity and enterprise shown by the designers of these engines provide many object lessons for the present day mechanical student and experimenter, however ultra-modern he may be in his



80 h.p. Le Rhone engine (1912) with cover of timing-case removed to show unorthodox form of timing-gears and double-acting cam ring. Note also that each pair of inlet and exhaust valves are operated by a single rocker and push-pull rod

(Crown copyright. From an exhibit in the Science Museum, South Kensington)

outlook. I contend that one can never afford to despise, or even ignore, the pioneer efforts of the past, in which prodigious problems were tackled with a determination we would do well to emulate.

A Handy Reference Chart

(Continued from page 736)

intermediate values can be easily determined by interpolation.

The radial speeds available on the user's lathe are then drawn horizontally across the chart and other lines representing the cutting speeds required for the commonly used materials drawn vertically.

The use of the chart is best illustrated by a couple of examples. (1) A shoulder is to be turned on a $\frac{3}{4}$-in. diameter mild-steel shaft. From the chart mild steel requires a cutting speed of 80 ft./min. This vertical line intersects the $\frac{3}{4}$-in. diameter line at 410 r.p.m. The nearest available speed is 380 r.p.m. on the intermediate cone pulley. (2) The tyre and flange is to be turned on a 3-in. diameter wheel in soft cast-iron. From the chart soft cast-iron requires a cutting speed of 60 ft./min. This vertical line intersects the 2-in. line at 115 r.p.m., and the 4-in. line at 55 r.p.m. Since 3 in. is the mean of 2 in. and 4 in. the mean of their speeds, i.e. $\frac{115 + 55}{2} =$ 85 r.p.m., gives the required nominal cutting speed. The top cone speed with the backgear engaged, i.e. 74.5 r.p.m., would therefore be used.

In my experience it is usually preferable in the case of most materials, and particularly ferrous metals, to use a speed somewhat lower rather than higher than that quoted, and it is important to note that these speeds apply to turning, boring, facing, etc. For any operations using a parting-off tool it is essential to use a speed at least one-half to one-third of those quoted if chatter is to be avoided.

A SMALL STEAM PLANT

by M. W. McGrath

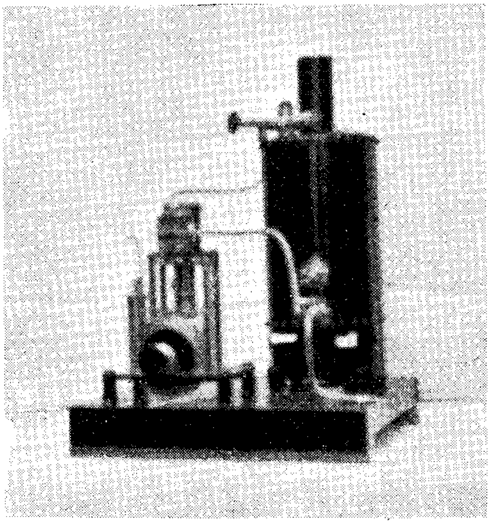
I HAD not done much model engineering between the two wars, but at the commencement of 1945 I felt the urge to start again.

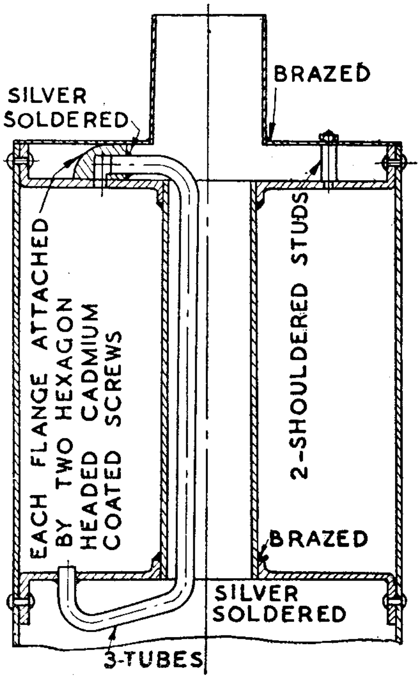
I had followed engineering in various capacities as a livelihood in the intervening years and had accumulated a fair number of hand-tools, mostly home-made, plus a certain amount of background. Stationary steam engines were my boyhood's fancy, so I decided that one of these would serve for a start. I tried without success to obtain THE MODEL ENGINEER, the only "words and music" available being a horizontal engine blueprint obtained from Messrs. Stuart-Turner's. No castings—no lathe. Here a ray of light lit the gloom, as a friend kindly offered the use of his large workshop on Saturday afternoons.

By one of Fate's usual tricks, when I had completed the job I secured a regular copy of THE MODEL ENGINEER, also access to past volumes back to 1939. The first step was to draw an outline full size "on the board" to determine main centres and general dimensions, afterwards getting busy.

The general layout of the plant is fairly plain from the photograph. Bore and stroke are, respectively, 1 in. × $1\frac{1}{4}$ in., double-acting slide-valve, cutting off at 60 per cent., fabricated cylinder, the walls being formed of a phosphor-bronze bush obtained from a commercial vehicle and of precision accuracy and finish. Trunk crosshead guide with side slots, case-hardened crank and crosshead pins.

Crankshaft diameter is $\frac{3}{8}$ in. with press-on flywheel and single balanced web. Main bearings were machined as one and separated by parting off; since they have an initial common base, alignment followed without "fiddling."





Arrangement of water-tubes

The four supporting "columns" are steel tubing containing long studs, the two rear ones being in four pieces, with the crosshead-guide bottom bracket nipped between. The crosshead-guide lower end is pressed in the bracket, the top end being pushed over a spigot extension of the lower cylinder cover.

I turned the piston-rod and crosshead in one piece, from a piece of rectangular steel held between chuck and tail centre; the method adopted may possibly be of interest. The steel was lined off and centred, then chucked in the four-jaw and the crosshead 5/32-in. pin-hole drilled and reamed. At the same setting, a circular recess was cut corresponding in diameter to the internal distance between the slippers. The bar was then reversed in the chuck and a similar recess cut on the other side. The piston-rod diameter was afterwards turned between chuck and tail centre, and the slippers formed, the rod being screwed 2-B.A. by die-box for the piston. A forked connecting-rod was built-up in three pieces to include a bronze big-end, screwed and sweated together. Lubrication is by hand-pump of $\frac{1}{4}$-in. bore, contained in a reservoir made from a discarded oil-gun and delivers *via* a clack to the steam-chest. The piston is of "Meehanite" has one ring and is tapped and lock-nutted.

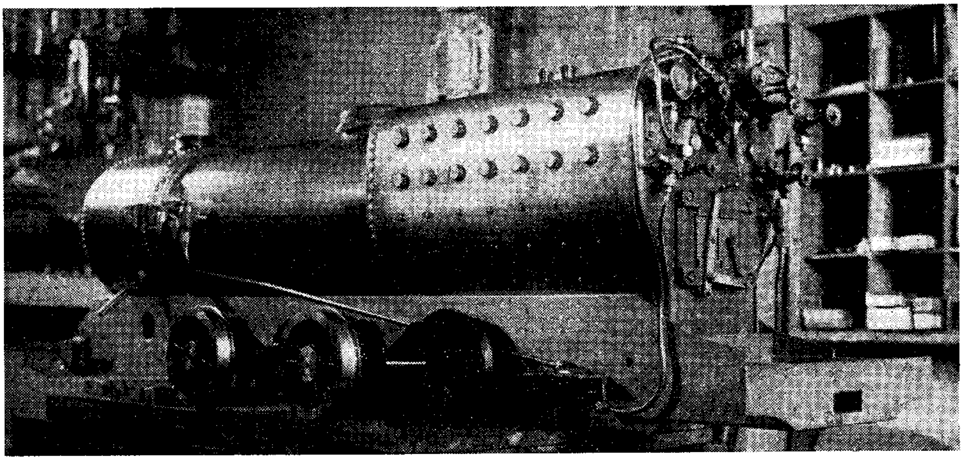
The boiler was made out of 5 in. × 3/32-in. weldless steel tubing and (*Continued on next page*)

Andover's Second Exhibition

WHEN Commander L. A. Brown, R.N.V.R. of Portsmouth opened the Andover and District Model Engineering Society's second annual exhibition, held during Easter Week, he said that model engineering helped to maintain the spirit of craftsmanship and that he was impressed by the quality of the models exhibited. These included models of all kinds loaned by our "good neighbours," Lymington, Southampton, Portsmouth, Newbury, Eastleigh, Basingstoke, Salisbury and the Isle of Wight. These loans, though not numerous, were fully appreciated, and we tender our thanks to all concerned.

On the home stands Mr. C. Barnet's massive 1½-in. scale Royal Scot (unfinished) dwarfed the rest of the exhibits. Traction engines were well represented by Mr. H. Smallbones's 3-in. scale Tasker's "Little Giant," while the Showman's engines of Messrs. O. T. Wicks and C. Barnet were running on compressed air throughout the exhibition. Also on the airline were several steam engines by Mr. O. T. Wicks and his son Mr. J. A. Wicks. Mr. Eastman's locomotive chassis showed good craftsmanship while Mr. Pemble's Pullman coaches, "O" gauge, complete with lamps and upholstery, showed what could be done with odds and ends and much patience. Mr. Vallat's exhibits occupied a major part of the solid scale model aircraft stand, on which, models ranged from the Wright biplane to the De Havilland Swallow. Mr. Bacon's Gloster Meteor deserves special mention owing to the superb finish and attention to detail.

Our I.C. fans, who, unfortunately, number only two or three members, were represented by Mr. Crouch's 5-c.c. "Kestrel," while our marine modellers, also in the minority, were not represented at all. This they hope to remedy at the next exhibition. Our chairman (Mr. Doughty) and Mr. Howell each exhibited a steam plant. Mr. Lillington's "King Arthur" type 1½-in. scale locomotive did splendid service, hauling passengers on both days. Messrs. Taskers of Andover loaned their magnificent models of the "Queen Mary" aircraft transporters. Sir Walter Alcock's Midland and Stirling singles delighted the eyes of those who love "vintage" locomotives. Admiral Sir R. Bacon kindly loaned a model of Nelson's "Victory," made by French prisoners of the Napoleonic Wars. Admiral Bacon re-rigged this model which is carved in bone saved from the prisoners' rations.



Mr. C. Barnet's 1½-in. scale "Royal Scot" during construction

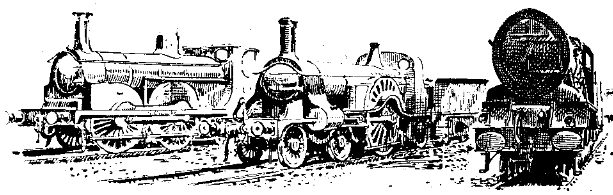
A Small Steam Plant

(*Continued from previous page*)

has a 1¼-in. centre flue. I could not obtain sufficiently ductile iron for the end-plates, so turned these from ½-in. steel slabs, accompanied on the back-gear by sundry groans and protestations!

Gas-firing was used and the steaming capabilities were somewhat disappointing; if the engine was speeded up for long, the 30 lb. or so registered descended to 15. I had THE MODEL ENGINEER by this time and was able to glean something from "L.B.S.C." and Victor B. Harrison. A likely solution seemed to be to fit water tubes; and, to employ these to advantage without disturbing the original construction unduly, I used the arrangement as sketched. This gave satisfactory results; steam is raised quickly and is dry, whilst pressure is maintained.

Incidentally, steam for the pressure-gauge, safety-valve and stop-valve are taken from a common turret which incorporates a ¼-in. gas filler-plug.



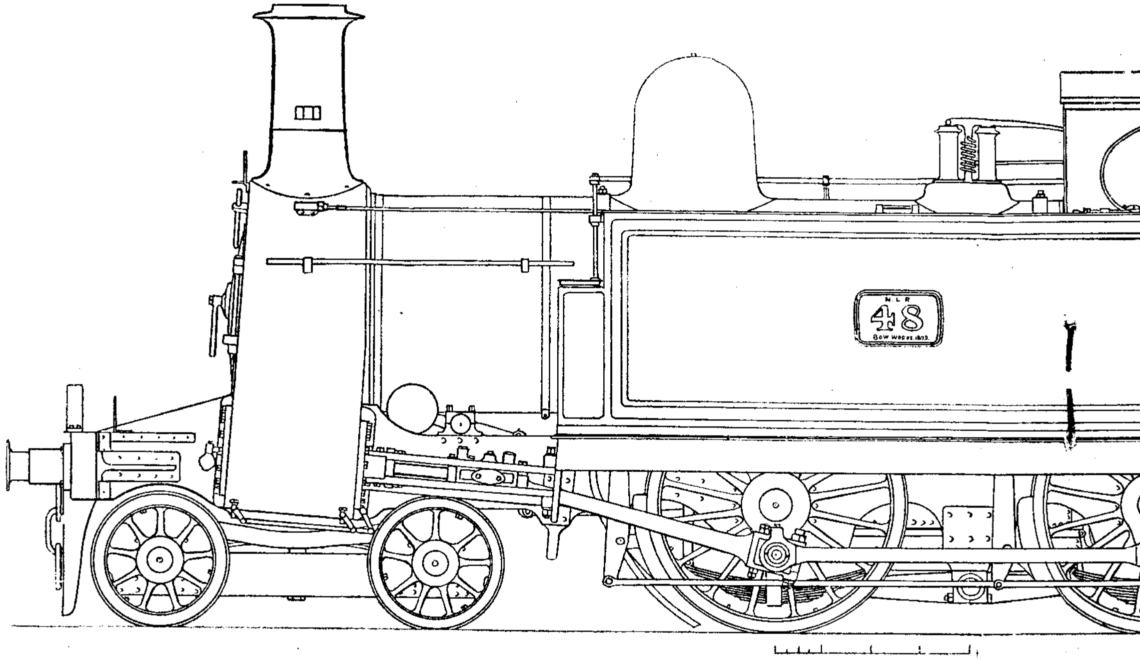
LOCOMOTIVES WOR

By F. C. HAMBI

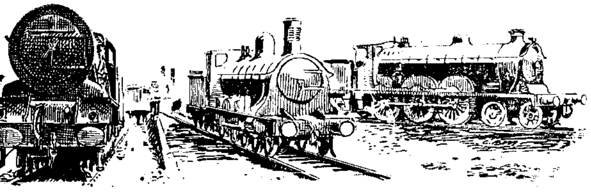
No. 23 North London Rai

IN some ways it was a good thing that the N.L.Rly. did not send a real locomotive to the Paris Exhibition of 1889. As I mentioned previously, the company contented themselves with showing a one-eighth scale model of their standard passenger tank—and a very fine model it was. The advantage of such big-scale work has always been that it brings with it the possibility of estimating with great accuracy the true appearance of the prototype. To place one's eye alongside such a model is the next best thing to standing alongside the very engine itself, and, though it brings with it the problem of storage, I for one, am never tired of singing the merits of the "large-scaler." This particular model gave all the world a chance to see what the Londoners could do when they turned their attention really seriously to the fascinating art of modelling—a skill, one rejoices to note, which manifests itself in still greater degree today, despite the bewilderments of a modern world. If anyone doubts this statement, then just let him go to the annual "Mod l E. g.ncer" Show and see for himself. That'll larn him! What a jolly engine was No. 48! A real Londoner, if you like. The original design came from an eminent engineer who, in his time held supreme sway at no less than three of London's locomotive works. No. 48 was built in London, and passed her long life as a most familiar friend of the citizens of the great metropolis, whose daily travels took them from the heart of the city to the numerous northern, eastern and western suburbs.

It all began in 1853, when that remarkable man, Mr. William Adams, who had been trained as a marine engineer in East London and had some experience at sea, came to the North London Railway. He planned and built the company's new works at Bow, invented his universally known four-wheeled side-play bogie, and designed three classes of engine before passing on to become chief at Stratford (G.E.R.) and Nine Elms (L.S.W.R.) respectively. The last of these three classes is the one now under review. Between the years 1868-1907, 74 of them were built, the last survivors being withdrawn in 1929. Very naturally, as time passed, some of the details were brought up to date by the two successors of Adams—Mr. J. C. Park (1873) and Mr. H. J. Pryce (1893)—but the fundamental layout remained unchanged. So now let us have a glance or two at the many interesting points of No. 48, built in 1883, and therefore a "J. C. Park version" of the old design. A nice, compact little engine with a pleasing upstanding appearance.



A beautiful green tank engine, the joint product of William Adams



WORTH MODELLING

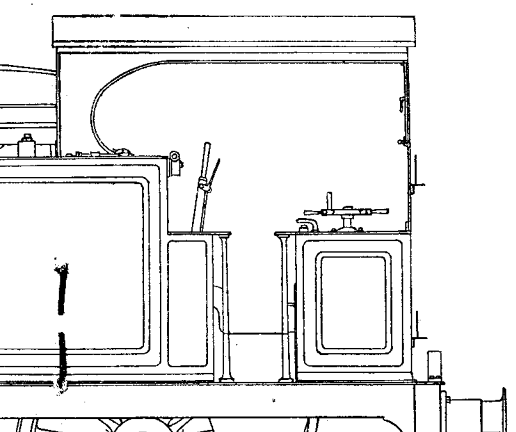
. HAMBLETON

London Railway, No. 48

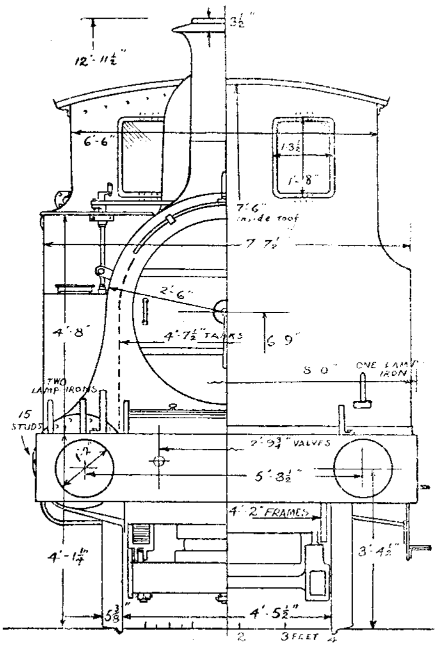
First, picture her smokebox sides curving away so gracefully over the cylinders, its front plate sloping slightly, since it is set at right angles to the 1 in 20 inclination of the piston rods. Above all this stands a fine chimney, so extraordinarily like the earlier Johnson Midland pattern that we wonder for the moment if we are not standing on Derby soil! Truth to tell, it is almost an exact copy, except that the top rim is an inch larger in diameter (2 ft. 3 in.) and that the internal chimney tapers the opposite way, *i.e*, smaller at the top than at the bottom. In this she resembles *Edward Blount*. One cannot recall many such examples in locomotive practice.

She is painted green, picked out with a black band lined on either side with a fine white line. In the year in which No. 48 was built the colour scheme was changed. Black took the place of green, and the lining-out—much resembling that of the old L.N.W.R.—was an elaborate one of red, white and light-blue—almost grey—bands. A nicely dished smokebox door was hung from two hinges, so long that they only terminated at the door's edge, and its other unusual feature was a single fastening handle which screwed through a boss in the interior cross-bar.

Turning to the motion the four slide bars guided a rather long 15-in. pair of slide blocks, whilst the big-end of the connecting-rod was a forked one, closed by a block and bolt at the outer end, the wear of the brasses taken up by a wedge and its bolt. Those locomotive enthusiasts who knew the Webb compound engines well will recall a similar design fitted to the celebrated *Jeanie Deans*. Two other North Western touches were the Ramsbottom displacement lubricators screwed into the centres of the cylinder covers and front steam-chest covers, and the weighbar shaft of the Stephenson link motion, which had its balance weights placed forward of it, and not to the rear as in most designs. I have said "two other N.W. touches," but really, when one came to look more closely at No. 48, there were a number of other details which smacked strongly of Crewe practice. For instance, the internal coal bunker, placed in the cab, reminded one of the numerous shunting saddle tanks spread all over the L.N.W. system; so did the 9-in. steam brake cylinder placed inside the aforesaid bunker, which actuated the engine brake. (A heavy counter-balance can be seen in my drawing attached to the brake-arm, to keep the brake at the "off" position.) Then again, the large and handsome dome cover, 2 ft. 6 in. in diameter by 3 ft. in height, was given the familiar outline of the Webb design,

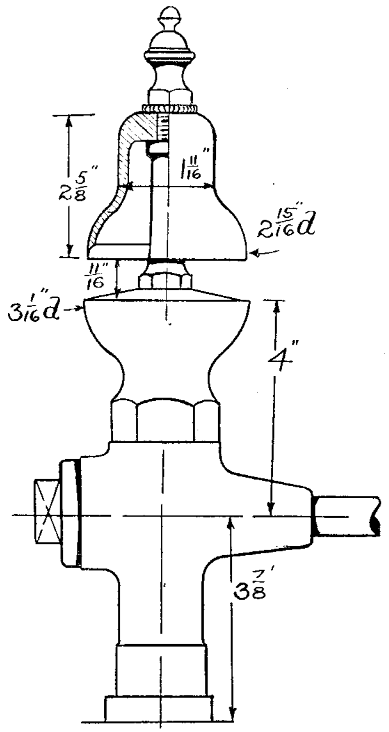


...lliam Adams and J. C. Park



The difference in the levels of the outward curves of front and back cab sheets can be clearly seen—Note the large 14-in. buffer head.

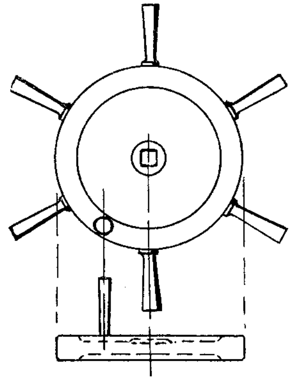
to say nothing of the destination boards, black with nice firm white lettering, and the head-board bracket riveted to the left-hand side of the chimney, immediately above its 13-in. high base. And, of course, in the general *ensemble*, the N.L.R. signals were extremely like the steel-arm variety produced at Crewe. Making comparisons is rather fun, especially when indulged in, not for the sake of finding a supposed superiority or inferiority, but rather to savour to the full the particular details of a fascinating engine such as No. 48 undoubtedly was! The tiny whistle—ah! that whistle (did ever a whistle scream such a high pitched note?)—was mounted at the side



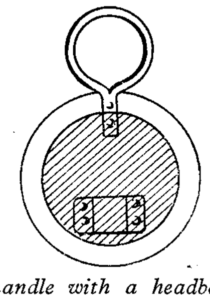
One of the smallest of locomotive whistles—a real Italian soprano!

of the safety-valve. This, at once, brought to the mind, the similar arrangement on the Holden G.E.R. engines. It also saved cutting an extra hole in the outer firebox plate! The hand-brake wheel was worth peeping at too. No wonder some of the boys mistook it for a steering wheel, and vainly tried to imagine the driver busily steering the whole train when running bunker first! It was a massive horizontal-wheel affair, a foot in diameter, its thick $1\frac{1}{2}$-in. rim set with six handles, to say nothing of an extra one for luck, which stuck up vertically! It was attached to a vertical spindle which rejoiced in a spherical bearing at its upper end to allow play for the arc-like movement below of the brake arm. The buffer-plank was a plank indeed, measuring 8 ft. by 1 ft. 5 in. by 6 in., and sandwiched both sides by thin steel plates.

From its centre hung a three-link wagon coupling. The radii of the ends of these links were rather larger than usual, giving a typical North-London effect. (Strange how these little details catch the eye, but when faithfully reproduced they all help to give the right atmosphere to our model.) So would the shape of the fine big square windows, the frames of which were hinged on vertical pins top and bottom, so that to open they were rotated in a vertical plane. Finishing touches come in the shape of the quaint little $10\frac{1}{2}$-in. headboards, with their enormous iron ring handles. These boards were white, or white with black spot, or red



A steering-wheel? Of course not—only the N.L. Railway hand-brake wheel!



A fine big handle with a headboard attached thereto! Very quaint

with white cross. Side elevations (as in the case of so many other engines) hardly do justice to our little tank engine. With her strange—nay, inconvenient—absence of platform over the slide bars, and the contrast of curved smokebox and square-sided tanks, she must be seen in perspective to be enjoyed to the full.

Useful Dimensions

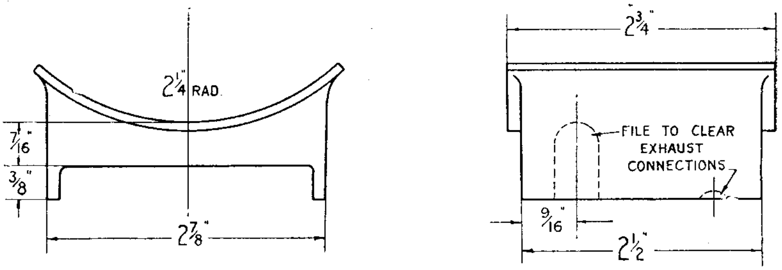
Cylinders, 17 in. by 24 in. Wheels, 5 ft. 5 in., and 2 ft. $9\frac{1}{2}$ in. Wheelbase: bogie, 5 ft. 8 in.; driving, 8 ft. 0 in.; total, 20 ft. $8\frac{1}{4}$ in. Overhang of frames: leading, 1 ft. 4 in.; rear, 5 ft. $6\frac{3}{4}$ in. Total length over buffers, 31 ft. 4 in. Centres apart of connecting-rods (6 ft. $1\frac{7}{16}$ in. in length), 6 ft. $1\frac{1}{2}$ in. Steam ports, $1\frac{3}{8}$ in. and 3 in. by $14\frac{1}{2}$ in. Lap of valve, $1\frac{1}{8}$ in.; lead, $\frac{1}{8}$ in.; travel of valve, $4\frac{1}{2}$ in. Throw of eccentrics, $6\frac{1}{2}$ in. Diameter of eccentrics, $15\frac{1}{4}$ in.

"L.B.S.C."

SMOKEBOX SADDLE FOR "HEILAN' LASSIE"

THE smokebox saddle may be either cast or built up. Our advertisers should be able to do the needful, and very little finishing off is required; merely clean it all over with a file, and see that the smokebox barrel fits nicely in the radius. An arch-shaped segment will have to be cut out of the right-hand side, to fit over the exhaust connection to the inside cylinder; the easiest way of doing this, is to drill a $\frac{1}{8}$-in. pilot hole $\frac{9}{16}$ in. from the front end, and $\frac{9}{16}$ in. from the bottom, then open out with a $\frac{7}{16}$-in. drill, and saw out the piece between the hole and the bottom edge of the smokebox saddle. Leave the gap narrow when sawing, and open out with a flat file until it exactly fits over the exhaust connection. File away a little bit of the left-hand side, to allow the exhaust-pipe flange of the left-hand cylinder to clear, when the lower edges of the saddle are $\frac{3}{8}$ in. below top line of frame. The longitudinal position of the saddle will be automatically located by the opening for the inside-cylinder exhaust-fitting. Adjust the saddle so that the bottom of the radius is $\frac{7}{16}$ in. above the top of frames, and temporarily clamp in position. Drill four No. 48 holes $\frac{3}{16}$ in. below top of frame, passing through frame and portion of saddle just below them, on the left side, at approximately $\frac{11}{16}$ in. centres; and three on the other side. Remove saddle, open out the holes in the frame with No. 40 drill, and countersink them; tap the holes in saddle 3/32 in. or 7-B.A. Also drill four No. 40 holes, same spacing, about $\frac{1}{8}$ in. below the edge of the flange at the top of saddle on each side; it can then be erected, and fixed with countersunk screws to match the tapped holes.

In the unlikely event of a casting not being available, a saddle can be easily built up by cutting out four pieces of 3/32-in. or 13-gauge sheet metal (any kind except aluminium will do) to the dimensions given for sides and ends, and brazing them together if steel, or silver-soldering if brass or copper. The flange is formed by a rectangular piece curved to the radius of the outside of the smokebox barrel, with the centre part cut away; this is brazed or silver-soldered to the sides and ends, and the whole issue cleaned up and fitted to the frames in the same way as a casting.



Smokebox saddle

Lagging the Boiler

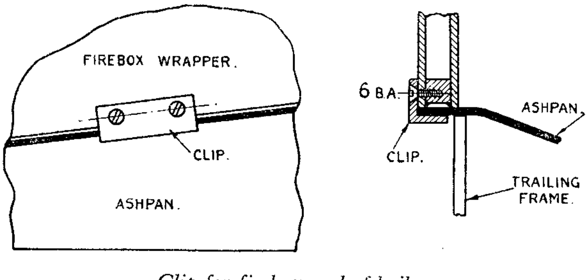
The boiler needs lagging to bring it to the same shape as the one on its big sister, and this job is more easily done when the boiler is off the chassis. There is nothing difficult about fitting the lagging; the only point is, that whilst the full size boiler is tapered for its full diameter, the little one has the taper at top and sides only, otherwise it could not be erected on the chassis at the proper height. This wouldn't matter a great deal with a small boiler—we had to put "Petrolea's" boiler proportionately higher up than in full size—as it would not spoil the appearance; but the "Lassie's" boiler is pretty near the limit of height as it is, and further raising would either mean increasing the load gauge, or cutting down the height of the already stumpy mountings. As either alternative would bring loud protests from Inspector Meticulous and all his friends and relations, we just fit the lagging as mentioned. The bottom of the $4\frac{1}{2}$-in. barrel can then sit right down on the frames, and everybody should be happy!

The small diagrams illustrate how the job can be done. The first 7 in. of the barrel doesn't need any lagging at all, as it is correct diameter. For the next $6\frac{1}{2}$ in., roll up a piece of thin sheet brass, taper fashion, so that the front end is $4\frac{1}{2}$ in. diameter, and the back $4\frac{13}{16}$ in. Cut a hole for the dome, right opposite where the joint will be. Now put some felt packing around the top and sides of the barrel; if you haven't any, use any old thing handy that will keep in the heat. I used some "real" stuff in the last boiler that I lagged; it was a piece of felt matting as used for the boiler of the Council steam-roller, pulled apart and thinned out to required thickness. I know somebody who used the legs of a pair of rayon stockings, the feet of which were too much darned, and the knees and upper part laddered, to be of further use to their original owner! Asbestos millboard or flock will do, but it isn't such a good heat insulator as felt or flannel, though beginners would hardly think that a fact.

The thin sheet metal is sprung over the lagging, and about the easiest way to secure it, is first to tie a few turns of string around it, then tack the overlapping edges with solder. The string

can then be removed, and the sheet metal cleading will "stay put" whilst you fix the boiler bands. These should be made from thin sheet brass cut into strips; or if you can get it, what is known in the metal trade as "ticket wire." This material is thin strip brass about $\frac{3}{16}$ in. wide, hard and springy; it can be bent around the boiler, the ends bent at right-angles, to form lugs, which are drilled No. 43, and an 8-B.A. brass screw and nut put through, as shown in the detail illustraticn. The end bands should overlap the ends of the cleat-ng sheet. Put one n betwe.n, and when the smokebox is attached, put another over the joint, and one between that and the dome, on the unlagged part of the barrel.

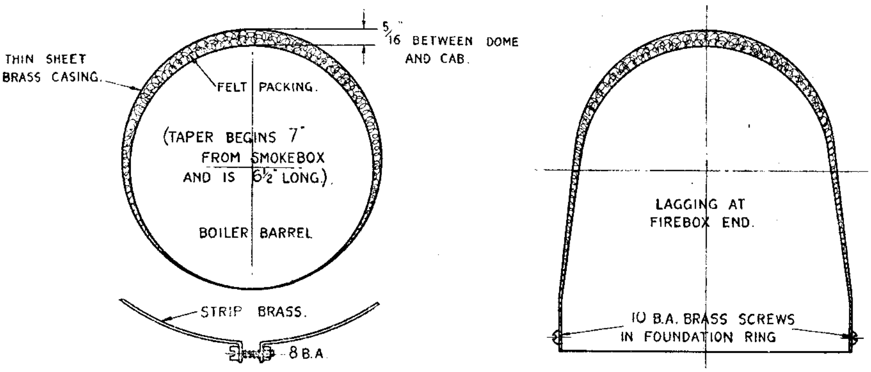
The rear section of lagging, which extends from the front section to the cab, is parallel at the top, and 6$\frac{3}{4}$ in. long. It requires a little careful fitting to get it nicely over the contour of the firebox wrapper, and you can see better how to do it by taking a good look at the actual job, than I could tell you by yards of explanation. The last one of this kind that I fitted with a cleading sheet, was the rejuvenated "Cock-o'-the-North," and I just made a paper pattern by wrapping a sheet of brown paper around the back end of the barrel and firebox, and snipping out the bits that overlapped at the corners and ends. The result was used as a template, when laid out flat, to cut a corresponding piece of thin sheet-copper, which fitted perfectly when bent to a curve over the top of the wrapper, and the lower ends tucked nicely around the throatplate. The dressmaker for whom I often acted as a living "dummy" in childhood days taught me a lot about her kind of "pattern-making," but I guess she never dreamed of some of the uses to which I put her teaching! The bottom edge of the cleading sheet over the firebox wrapper, can be secured by 10-B.A. or $\frac{1}{16}$-in. screws, as shown in the detail illustration. The boiler band at the end of the first section, overlaps the beginning of the second, and another one goes between that and the cab end.



Clip for firebox end of boiler

How to Erect the Boiler

First put on all the blobs and gadgets that you have made to go inside the smokebox; the blower-jet assembly, which only requires the union-nut screwing on to the end of the hollow stay, and the superheater assembly. Put a washer or gasket of 1/64-in. Hallite or similar jointing material, between the wet header and the steam-pipe flange, and see that there is a hole in the middle that won't obstruct the flow of steam. That may sound superfluous—well, don't you believe it! I've known plenty of cases where a "blind" gasket has been fitted. Once or twice, when we couldn't get the sands to run on the Brighton engines, it was found that the washer between the sand-box flange and the one at the top of the sand-pipe, had no hole in it! Put a smear of plumber's jointing around the joint-ring that connects smokebox to boiler, and put the smokebox on. A little judicious manipulation will get the union fittings on the steam-pipes through their respective holes in the sides of the smokebox. Make certain that the smokebox is quite vertical in relation to the boiler, and then put the lock-nuts on the unions.



Details of boiler lagging

Now put the boiler on the chassis; it will automatically be located by the blast-pipes, and the recess in the trailing frame. The smokebox should seat nicely in the radius of the smokebox saddle, and the barrel should rest on the top edges of the high part of the frames. To hold it down at the smokebox end, put the No. 40

drill through the holes in the flange of the smokebox saddle, making countersinks on the smokebox; follow up with No. 48, tap 3/32 in. or 7-B.A. and put in roundhead screws, brass for preference. To prevent shifting of the back end until you get the cab on, use two little bits of ⅜-in. angle, halfway along the bottom of the firebox, as shown in the detail illustration. These should be about 1 in. long, with two No. 34 countersunk holes in each, through which pass 6-B.A. countersunk screws running into tapped holes in the foundation ring, as shown in the section. They can be placed outside the cleading, and if preferred, may be removed after the cab is fitted, though it would be best to let them bide; they are unobtrusive, and a good insurance in case of derailment or collision, which might damage the cab and let the back end of the boiler loose, to the detriment of pipe connections and so forth. These clips allow the boiler freedom to expand, taking the place of the swinging links which I sometimes specify for the same purpose.

Finally, connect up the inside cylinder union, and put a bit of plumbers' jointing around the places where the steam-pipes and blast-pipes pass through the smokebox; give the edge of the smokebox front a dose of the same medicine, and press it into place, taking great pains to ensure that the hinges on the door are exactly horizontal, and not emulating the antics of a signal arm of the kind which the kiddies say "goes up for down." If the joint-ring between smokebox and barrel, and the fit of the front ring, are as good as they should be, no further fixing is required (I never fix them) but if there is any slackness, put a few small countersunk screws through smokebox shell, joint-ring, and flange of the smokebox front. About four brass screws, 3/32-in. or 7-B.A. countersunk, will be ample, in each joint.

The two pipe fittings connecting the unions projecting through the sides of the smokebox, to the steam-chest covers, can now be put in place with a thin oiled-paper gasket between the flange and the cover. If piston-valve cylinders have been used, the method of connecting that kind has already been explained. There only remain the oil-pipes, the union-nuts of which merely need screwing on to the nipples on the steam-pipes. If a little air is pumped into the boiler *via* one of the feed clacks on the backhead, and the regulator opened, the wheels should turn quite easily, with the chassis jacked up and the axleboxes in the running position; the little blocks of metal between axleboxes and hornstays should not be removed until the engine part is completely finished, as the final adjustment of the spring plates and nuts is made with the engine in full working order, with the boiler three parts full of water. Incidentally, the old L. & N.W.R. folk at Crewe used to fall down pretty badly on this point, as they set their valves in the works when erecting; and as the setting of a Joy gear varies with the position of the axleboxes in the horns, the shed fitters at Camden and other depots had to do the job again with the engine ready for the road.

With about 30 or 40 lb. of air in the boiler, and the wheels braked by holding a block of wood against the tread (*don't* try it with your fingers; you might get a friction burn and lose a bit of skin) "Lassie" should puff vigorously with her six beats per turn. Open the smokebox door, and apply a flame, such as a lighted taper,

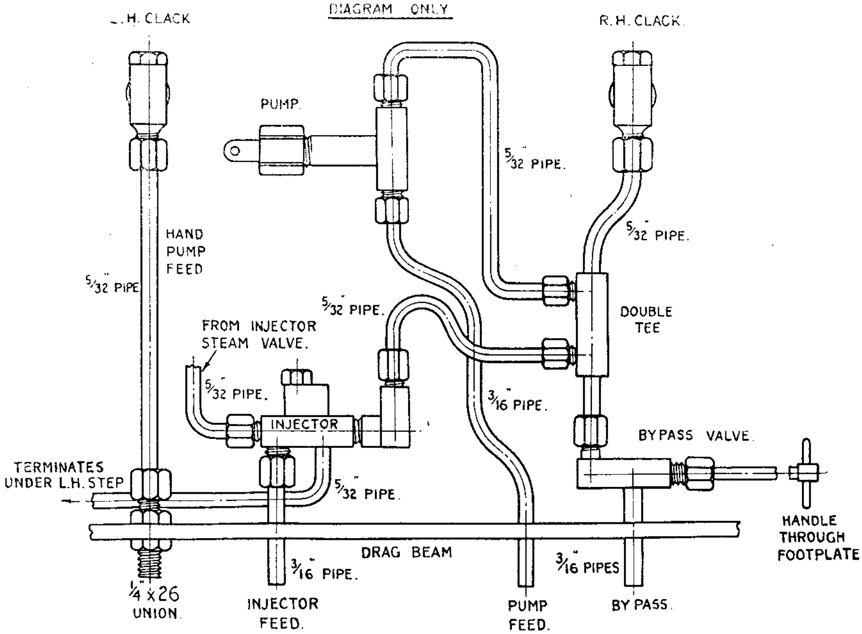


Diagram of pipe connections

between the blast-nozzles; the flame should be sucked up the liners. Same should occur if the regulator is shut and the blower valve opened. Shut the smokebox door and hold the taper to the open firehole door; flame should be sucked inside by either blast or blower action. If not, either the blast-pipes or blower-rings are not lined up correctly with the chimney liners, or air is being drawn in at the front end. Either defect is easily remedied.

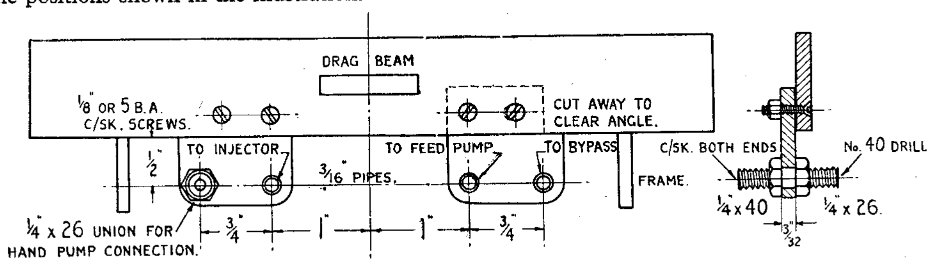
Water-Pipe Connections

Now we come to what is literally a plumbing job; that is, the water-pipe fitting. The legendary plumber always forgets something, or has to go back for his tools; take care not to emulate him! I have shown the pipe connections in diagram form, like the wiring diagram of a car or radio installation, because it doesn't really matter where the pipes run, as long as they start and finish at the right places, are free from sharp bends or kinks, and look neat. As old followers of these notes know well, I have a "standard" (horrid word) arrangement of pipe connections between engine and tender, so that any tender can be used with any engine; old "Ayesha's" tender has been used to test every $2\frac{1}{2}$-in. gauge engine that I have built. The reproduced drawing shows my usual arrangement for $3\frac{1}{2}$-in. gauge, in all cases where the engine is furnished with both pump and injector feed. Two small supports are made from pieces of 13-gauge or 3/32-in. brass or steel, $1\frac{1}{4}$ in. square, the bottom corners being rounded off, and one top corner rebated to clear the fixing angle on the drag-beam. The right-hand support has two $\frac{3}{16}$-in. clearing holes drilled in it at $\frac{3}{4}$ in. centres, but the other one has the left-hand hole drilled $\frac{1}{4}$-in. clearing. Both supports are attached to the inner side of the drag beam by $\frac{1}{8}$-in. or 5-B.A. countersunk screws and nuts, at the positions shown in the illustration.

Alternatively, the hole in the support can be tapped $\frac{1}{4}$ in. by 40, the fitting screwed tightly home, and the lock-nut used for additional security to prevent the union turning when coupling or uncoupling the engine and tender, and disconnecting the hand pump feed pipe.

The $\frac{1}{4}$-in. by 40 end is connected to the left-hand clack on the backhead, by a piece of 5/32-in. copper tube with a union-nut and cone on each end. I have already described in detail, how to make these, for beginners' benefit; and would add that this kind of union attachment is the best I have found, in over half-a-century's actual locomotive building. Doing away with the usual tail-piece on the cone, not only enables smaller and more realistic nuts to be used, but gives a better appearance (you've only to look at any of the footplate fittings on my own engines!) and only an out-and-out Billy Muggins would be green enough to make a pipe bend so close to the back of the nut that it couldn't be unscrewed. I credit followers of these notes, even raw recruits, with having a little more of the commodity commonly known as "gumption," than to do that! A good tip for "entered apprentices" of all ages at locomotive plumbing, is to use a bit of lead wire (commercial article) same thickness—or nearly so—as the pipe to be fitted, as a template for getting the exact length of pipe required. I always use a bit, bend it to the curves required for an easy run between starting and finishing points, straighten it out, cut my copper tube to exact length indicated by the wire, put on the union-nuts, silver-solder the cones on each end, softening the pipe at the same time, pickle, and clean up, bend the pipe to the same curves, and it fits perfectly; the nuts are screwed up easily, and not an eighth of an inch of pipe need be wasted.

Measure the distance between the bottom union of the eccentric-driven pump and the bracket on the drag-beam, with a bit of lead wire as above, and cut a piece of $\frac{3}{16}$-in. copper tube accordingly, allowing $\frac{1}{2}$ in. extra for projecting beyond the bracket, to take the connecting hose, which enginemen call a "feed bag." Fit a $\frac{5}{16}$-in. by 32 union-nut and cone on one end, and couple up to the pump, putting the tail end through the bracket, as indicated by the diagram. The pipe takes a direct route under the ashpan.



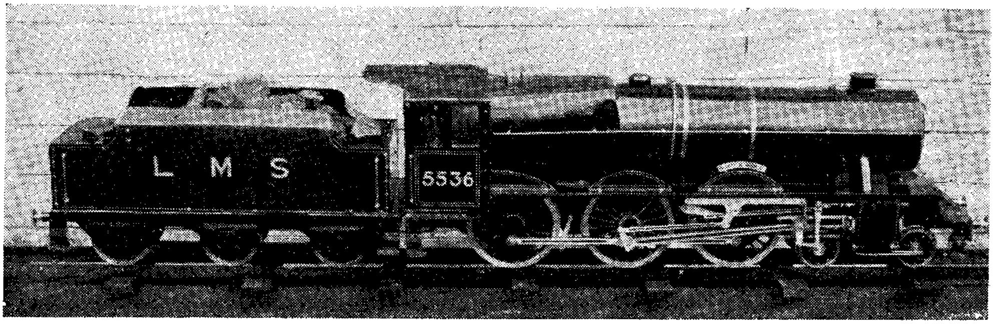
Connections between engine and tender

To make the double union for the hand-pump connection, chuck a piece of $\frac{5}{16}$-in. or $\frac{3}{8}$-in. brass hexagon rod in three-jaw; face, centre deeply, turn down $\frac{5}{8}$ in. of the outside to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. by 40. Part off 1 in. from the end; reverse in chuck, turn down $\frac{1}{4}$ in. of the outside to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. by 26. The coarser thread is more lasting and quicker in action, when coupling up engine and tender. Centre deeply, and drill right through with No. 40 drill. Put the long end through the hole in the bracket, and secure with a locknut made from the same size hexagon rod.

Another Fine First Attempt

Being always ready to give a praiseworthy beginner a hearty pat on the back, it gives your humble servant great pleasure to illustrate the work of a Leicester "cop," to wit, Police-

Constable J. Briars. Our worthy friend took a fancy to the L.M.S. "5XP" class engines working between his home town and London, so decided to build a $3\frac{1}{2}$-in. gauge edition, using my notes on the $2\frac{1}{2}$-in. gauge "Olympiade" as a guide; but as it was his first effort, he decided on two cylinders only. These are $1\frac{3}{16}$-in. bore and $1\frac{5}{8}$-in. stroke, with working drain cocks. Being rather tickled with the back slope of the full-sized engines' fireboxes, he made the little one to the same pattern, otherwise all the rest of the job conforms to "words and music." The engine is a good steamer, and pulls very well. Great care was taken with the painting and lining, three coats of maroon enamel being applied, and the final being rubbed down with metal polish, so that no brush marks are visible. Our "brother-in-law" (and order!) deserves sincere congratulations on his fine effort, but I reckon he made one mistake, in the name given to the engine; in view of his profession, she ought to have been called "Sherlock Holmes!"



Mr. J. Briars $3\frac{1}{2}$-in gauge "5XP"

For the Bookshelf

Rotary Valve Engines. By M. C. Hunter, (London: Hutchinson's Scientific and Technical Publications, 47, Princes Gate, S.W.7.) Price 21s., postage 6d.

Modern technical books on engineering design are often open to criticism in that they deal only with the factual and statistical side of their subject, and omit or dismiss briefly the equally important aspects of development, the reasons for the adoption of various features of design, and the causes of success or failure in the past. Even when a historical review of the subject is included, it often fails to stress these points, which are not only of outstanding interest, but also of great value to the serious student of design.

Such a criticism cannot be made regarding the book under review, which not only traces the history of all types of rotary valve engines up to the present time, but also delves deeply into the whys and wherefores, the principles and practice of the subject, and forms a sound basis for further experimental research. It is the first book devoted entirely to the subject of rotary valve engine design, and though the author is obviously an enthusiast, he is no idle dreamer or propagandist, determined to put over the virtues and advantages of his favourite type of engine, while ignoring or glossing over its limitations and defects. The practical reasons why the promise of various schemes for the adoption of rotary valves in the past has not yet materialised are impartially examined, and the author is able to draw on practical experience to support his theories; while not afraid to draw conclusions or make conjectures, he is careful to keep them in their proper place and to segregate them from authentically observed facts.

The first part of the book, dealing with working principles and historical development, describes the early rotary valve engines, including the Crossley, Darracq, Itala, Minerva-Bournonville, and other engines, leading up to modern examples such as the Cross and Aspin engines. As may be expected, the latter two engines are dealt with in great detail, and some excellent illustrations are given of the latest forms of design in each case.

It is interesting to note that the Burt McCollum type of sleeve valve, as used on the latest Bristol and Napier aircraft engines, is capable of classification as a rotary valve, since any point on the sleeve traverses a circular or elliptical path. The book is not confined to descriptions of rotary valve I.C. engines, as it is made clear that the principles have also been applied in connection with other forms of motive power.

How many students of locomotive design know that a steam locomotive with rotary valves was used with a certain degree of success on the Midland Railway in 1908? Rotary valves have also been used on compressed air engines, particularly compressed air starters on motor car and aircraft engines. One would like to have seen this aspect of the subject pursued further; for instance, to include the rotary-valve cam-track engines of the old type Desoutter "Mighty Atom" air drill, also the hydraulic swashplate engines used in the Navy for operating gun turrets, and last, but not least in importance, rotary admission valves in two-stroke engines—none of which are mentioned in the book. But it is obvious that in attempting to cover so wide a field, certain omissions are inevitable, and concentration on the types of engines which present major problems in design is right and proper.

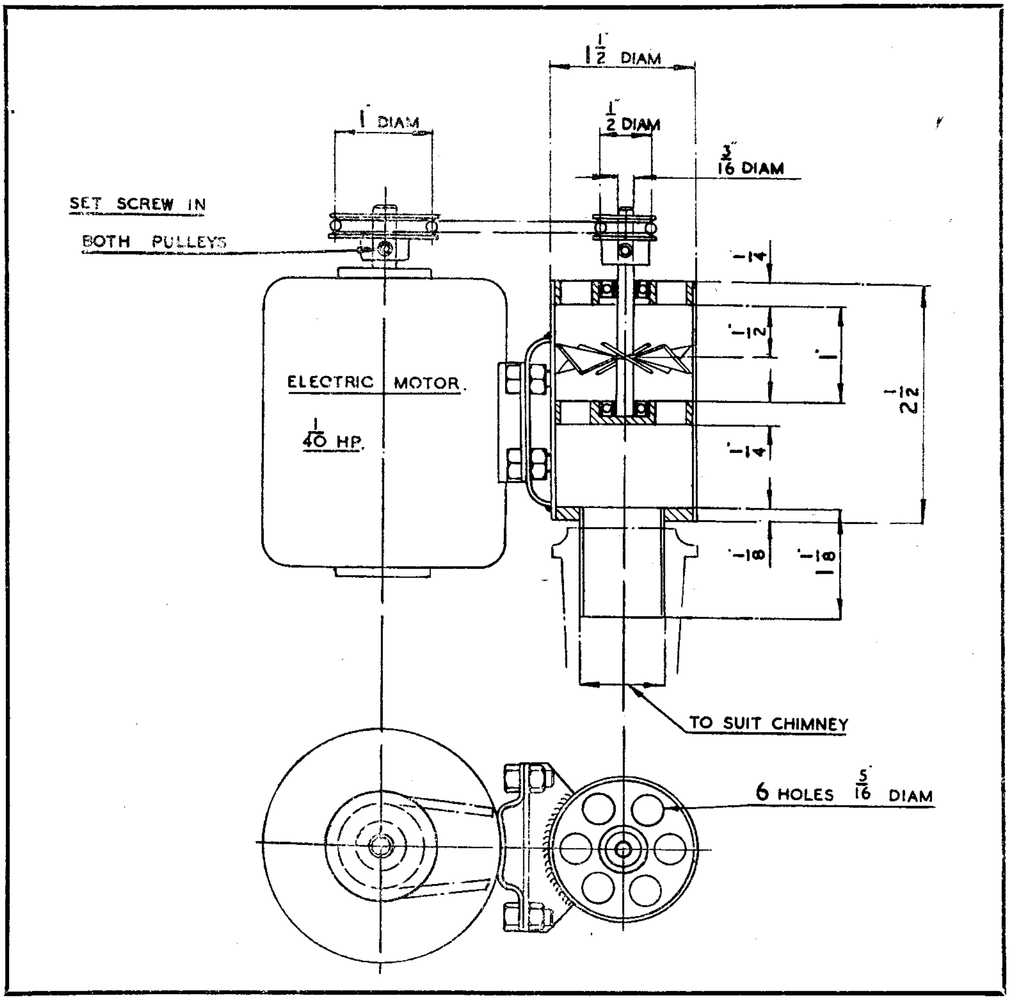
A SUCTION FAN for STEAM RAISING

by R. Charles

HAVING just finished building one of "L.B.S.C.'s" $3\frac{1}{2}$-in. gauge locomotives to his "Words and Music" and, being a lone hand, I h d great difficulty in getting the fire started.

First obtain two pieces of 18-s.w.g. copper tube, one $1\frac{1}{2}$ in. o.d., $2\frac{1}{2}$ in. long, and the other diameter to fit the chimney and $1\frac{1}{8}$ in. long.

For the top bearing plug obtain a piece of brass of suitable size, chuck in a 3-jaw, then centre



I found that (using the air pump and extended chimney method) I could not pump and tend to the fire properly, so I devised the following suction tube to overcome the difficulty.

and drill 31/64 in., after ream out so that the outside of a $\frac{3}{16}$-in. $\times$ $\frac{1}{2}$-in. ball-race is a tight fit in this hole.

(*Continued on page* 753)

FUTURE PLANS

A review of an informal competition organised with the object of finding the views and requirements of model petrol engine constructors

by Edgar T. Westbury

IN THE MODEL ENGINEER, dated January 23rd of this year, I invited model petrol engine enthusiasts to submit their ideas on the most likely or desirable line of development of model petrol engine design in the future. The letters received in response to this invitation have not been numerous, but have all been extremely interesting and valuable as an aid to shaping future policy in "Petrol Engine Topics." It is clear that, although all the writers have fairly strong views on the subject, no two of them agree exactly on the best type of model petrol engine; it would appear that the "ideal" model petrol engine is as elusive as the "ideal" lathe! In some cases there was a tendency to digress from the essential points at issue, and only a small number of readers dealt with the subject in the order and under the headings I suggested.

As already pointed out, I considered it desirable to submit these letters to an independent and unbiased opinion, rather than rely on my own judgment in dealing with them. As a matter of fact, two scrutineers were consulted, and it is interesting to note that although there was no collusion between them, their findings agree as to the placing of the essays received.

The first prize of two guineas is awarded to Mr. T. Brooks, of Rochdale, who, in a long and chatty letter, gives me an account of his adventures in model petrol engine construction up to date, including the construction of a 15-c.c. two-stroke before the war, and work now in progress on an "Atom V" engine; also some comments on the difficulties encountered in running a home workshop in such a way as to avoid annoyance to neighbours. Mr. Brooks is evidently a model power boat enthusiast, and he suggests that the immediate requirements of constructors are not so much new engine designs, as information on how to get the best results from them. He says "ninety per cent. of your readers are model power boat fans . . . but after building good engines, we are left to fit them in boxes with twisted metal blades fitted on shafts poking through the floor of said boxes!" (Quite a concise description of many model power boats, I am afraid!) What he thinks is most necessary at the moment is some information on hull design and essential fittings, including pumps, delay-action devices, gearing, propeller design, etc.; he also asks for my views on diesel engines and jet propulsion —and "when you have finished all these, start on two-strokes again!"

Mr. Brook's letter may have many literary shortcomings, but he certainly knows what he wants and expresses it in no uncertain manner. I am in complete agreement with him that a series of articles on model speed boat design is much overdue, though whether I am qualified to furnish it, or whether other readers will agree that it has any direct connection with "Petrol Engine Topics," are entirely different questions.

As a contrast, the second prize winner, Mr. L. G. Callis, of Ruislip, submits a very concise letter, which is so well written that I reproduce it practically verbatim:

"Why are you building a petrol engine? Why don't you build a model engine in which you can see the movements, and so admire the work you have done?'

"As an enthusiast of the petrol engine, I am often asked these questions, and it is worth while to ponder and get the meaning of these phrases. The petrol engine does not appeal to many model engineers, simply because it has not the attractiveness of the steam engine with all its moving parts.

"The average engineer in charge of reciprocating engines generally wears a proud look on his face as he watches the gleaming cranks and rods move to and fro, and seems to derive a certain amount of satisfaction in his charge. Now, if we were to put a petrol engine in its place, no doubt we would note a slight change in his demeanour. The engine is still doing the necessary work required, but somehow it has not the attractiveness of the steam engine, so it is up to us to make the petrol engine have the desired appeal.

"I would like to see more engines similar to Mr. Goodchild's model as exhibited at THE MODEL ENGINEER Exhibition last year, and the size I would suggest would be 30-c.c., 4-cylinder o.h.v. There are many models of two-stroke engines on the market, and real good models some of them are, but I still maintain that the multiple-cylinder type of engine tests the skill of the model engineer, and that is the answer we want.

"The 30-c.c. type of petrol engine can be put to various uses, and one I had in mind would be to couple it with a dynamo, and make a model lighting set, providing it was suitable; if this was so, then we would also cater for the electrical enthusiast, especially if it incorporated a magneto as well.

"This size of engine might also be usefully employed in a model car. I am only surmising this, as I have not the full experience to say it would, but I think it would be a popular model, especially if one were able to sit on a trolley and have the thrill of driving the car.

"The majority of model engineers are keen locomotive builders, and when the model is completed the difficult problem arises; Where can a track be made? We are not all lucky enough to have a nice big garden, so it means our pleasures are curtailed as well.

"The model petrol driven car would offer advantages, because, given a fairly flat surface,

one could certainly do a little driving, if only in circles.

" I hope these little suggestions will be considered when out official planning begins to materialise, and that we will gather more enthusiasts in the near future."

Mr. W. S. Laycock, of St. Albans, whose first adventure in model petrol engine construction was the " Zephyr " $2\frac{1}{2}$-c.c. two-stroke, which seems to be living up to its reputation, is now working on a $7\frac{1}{2}$-c.c. " split single " two-stroke of his own design, and states that the initial results are extremely promising. This engine is intended for use in a model racing car, and the latest report describes a rough b.h.p. test in which a power output in the region of 1/3 h.p. was recorded. Mr. Laycock is of the opinion that engines from 5 to 10 c.c. will be the most popular in the future and that there will be a tendency to more specialised design of engines for single purposes in model cars, boats and aircraft. In all cases, however, there will be a demand for higher power/weight ratios. No phenomenal advances in the design of single-cylinder engines is expected, but there is a good deal of scope for the development of the " multi," which offers possibilities for supercharging, and he thinks that eventually the four-in-line engine of about 10-c.c. total capacity, with exhaust turbo supercharge, will be the standard racing unit for model cars and boats. He offers the opinion—which, I suggest, may be open to dispute—that the " large " single, of 15 to 30 c.c., is rapidly going out of fashion for all purposes, and that even in the " multis," the smaller capacities will be the more popular.

Another very well-written letter comes from Mr. A. L. Steels, of Cheam, Surrey—and here I may put on record my personal knowledge that both Mr. Steels and his son Ian are practical enthusiasts, the latter having won a prize for an excellent compression-ignition engine at a recent exhibition of the Sutton Model Engineering Club. Mr. Steels writes :

" 1. What type of engine do I intend to build or would like to see described ? Well—I want to build a multi-cylinder, four-stroke engine—not exceeding 10-c.c., so as to comply with the rules of model car racing. Here I should point out that my knowledge of petrol engines is very limited, and ask you to keep this before you as you read on. The engine I have in mind has four cylinders—air cooled for simplicity —$\frac{9}{16}$-in. bore and stroke would bring it within the maximum capacity mentioned, and be of such a height as would enable it to be mounted in its proper place in a suitably proportioned model car of approximately the same size as those now being constructed. Now—if we can tack on a small magneto I feel that we shall be able to ' go places ' — metaphorically speaking, of course.

" 2. The use for this engine is already answered—in a model car. You will notice that I have not said model *racing* car, and my reason for this is forthcoming in the next paragraph.

" 3. What, in my opinion, is likely to be the most popular line of petrol engine development in the future ? I have already mentioned my inexperience—I have built only one single-cylinder two-stroke engine which, after many trials and tribulations, was eventually persuaded to turn over under its own juice. I have, however, mixed with users of petrol engines, and come to the conclusion that, with certain exceptions, the two-stroke single is a wee bit too temperamental to satisfy me. There is no doubt at all that when they do function they can produce the ' urge,' but how often do we see the perspiring efforts to start, say a model car, for an exhibition or competitive run—the eventual result sometimes being an ignominous retreat from the starting line—all this to the accompaniment of advice (good or otherwise), critical, and allegedly humorous remarks ! No, Sir, this is not for me—I am too bashful—or more likely too short-tempered. I want to take hold of my starting cord firmly by the right hand (or would it be left ?), yo, heave ho—and Bob's your uncle !

" Yes, I know that the ' spiv ' racers will say that I won't get the speed—probably not on a single run, but I want the rules altered so as to take the average of, say, three runs *with a time limit for starting*. I could get a great deal more satisfaction from three trips at 40 m.p.h., than from one trip at 60 m.p.h., followed by two wash-outs. Multi-cylinder engines in the smaller sizes have not had much attention as yet, so perhaps they might be developed to attain really high revs.

" You may think that my opinions are too heavily biased, but I do feel that users of petrol engines generally will come round to an appreciation of reliability—and this would appear to be more likely of achievement with my favoured type of engine. Engines for model airplanes are perhaps a different proposition, but here again I would like to see the four-stroke engine tried out, even if it has to be a single cylinder. But, so far as I can see, almost anything will suffice to pull a plane up into the blue—the main concern is to get it down again without busting the whole caboodle !

" 4. I have no favourite size of engine, except in so far as they should be suitable for their job. I wouldn't build an engine unless it was going to move something—there are so many interesting things to make other than ' shelf ' models—and earning one's living does take up such a lot of a fellow's valuable time ! ! ! "

Mr. Chas. Snowden, of Seaham, Co. Durham, calls for the consolidation of existing knowledge on design, and his letter reads as follows :

" This letter cannot be considered as a direct reply to the four-point questionnaire put to readers, but rather as a counter-proposal.

" The reasons for the following thoughts are twofold, viz., my own lack of experience, and the goodly number of outstanding engines which you have already designed.

" Generally speaking, it is true to say that the inexperienced are the most enthusiastic regarding unorthodox designs—' Fools rush in where angels fear to tread ' ; whilst experience, on the other hand, produces a wiser, if not sadder man. It is to the latter that we should address our request for ideas.

" In view of the number of reliable engine

designs already published, should not the performance of the proposed engine be compared with that of its predecessor on a basis of cubic capacity and type, and the design published if, and only if, its performance will eclipse that of its forerunner?

"If this be logical, and if the new engine will only have a comparable performance, then I suggest that a handbook of standard designs be compiled from those engines already described in THE MODEL ENGINEER journals. This would provide the beginner with tried and trusted designs, and the more advanced worker with an excellent basis upon which he can 'improve' to his heart's desire.

"The handbook should preferably deal with each engine in turn, giving working drawings, machining hints, details of performance and any peculiarities in behaviour. Carburettors should be treated in like manner and cross-referenced with respect to the various engines with which they may be used, and the resultant effects on performance.

"Whilst most of this information has been published, it must be admitted that it is often difficult to find, and the proposed form should prove popular. An alternative would be to produce separate and uniform booklets for each engine, should the cost of one volume be prohibitive.

"In conclusion, therefore, I call for the consolidation of existing data, rather than the creation of more chaos and confusion by producing new designs at this stage. In this respect I hope I have not struck anger in the hearts of other would-be designers, and I know that you will consider these ideas in the spirit in which they are tendered."

While I agree with Mr. Snowden on the desirability of publishing statistical information such as he suggests, I see many practical difficulties in carrying it out. To make the publication of a design conditional on its eclipsing the performance of its predecessor would not only tend to restrict the scope of experimental design, but would also be very misleading, because performance does not depend on design alone, but on a combination of factors, in which materials, workmanship, finish, and adjustment all play important parts.

Finally, yet another very different opinion is expressed by Mr. F. Read, of Hengoed, Glam., who calls for an unpretentious, but willing, hack which will earn its own keep.

"I do not expect my plan will have a solitary sympathiser among readers of THE MODEL ENGINEER, but you have asked for it!

"1. The engine to be of abysmal simplicity, without electricity, castings, compression, cooling, or any other frills. On the lines of the gas engine described by B.C.J. some time ago: flame ignition at 1/3 stroke, wick carburettor like the old petrol-air gas generators, automatic valves, about 100 c.c., docile and without a kick in it. The sort of animal the ladies of the house would not be afraid to handle. An engine, in fact, which you, sir, could design *between the courses of a light lunch and build before tea*." [?] [The italics—and the question mark—are mine!]

"2. Here you may suspect a glimpse of the cloven hoof. It will be required to drive the cutters (not the locomotion) of the domestic lawn mower.

"3. The two-stroke, in very much its present shape, seems to me the most likely bid for continued popularity, with compression ignition in some form. Its compactness pleases the eye as well as the mind, and its real simplicity, when designed for simplicity, is very satisfying.

"4. My preference is for something with some power in it—30 c.c. to 50 c.c."

A Suction Fan for Steam Raising

(*Continued from page* 750)

Turn down the outside of the brass bar so that this is also a tight fit in the copper tube, then part-off a slice ¼ in. thick.

Around a circle of ½-in. radius on the brass plug drill six $\frac{5}{16}$-in. holes spaced equidistant to provide an exit for the smoke.

The bottom bearing plug is similar, except that the recess in the centre to locate the ball-race is a blind one.

To make the bottom ring to locate the small chimney tube, chuck the brass bar again, and turn out a ring so as to obtain a tight fit in both tubes, then part off a slice ⅛-in. thick.

The fan is made from a disc of 18-s.w.g. mild-steel, cut and twisted to form six blades; be careful to twist them the right way so that the fan will suck, the twist depends on the direction of rotation of the motor.

For the fan spindle, select a piece of $\frac{3}{16}$-in. silver-steel, 2¼ in. long, that is a tight fit in the inside of the ball-races, and at ⅝ in. from one end, braze on the fan disc.

To assemble the suction tube, first press in both bearings in the top and bottom bearing plugs, then stand the suction tube on a block of wood or lead, and, with a wooden drift knock the bottom plug into the tube for a distance of 1½ in.

Then obtain a piece of round wood of 1⅜ in. diameter and clamp in the vice; over this wood place the suction tube so that it forms a support for the bottom bearing plug.

While in this position drive the fan spindle into the bottom bearing, and then drive the top bearing and brass plug down the spindle until the plug is flush with the top of the tube.

After this, fit the bottom ring and chimney tube in position; if you should make these a loose fit, you can run some soft solder around the joint.

The electric motor used for driving the fan is a 1/40-h.p., and revolves at 6,500 r.p.m.; the mounting plate is soft-soldered or brazed on to the side of the suction tube. Mine is soft-soldered on, and stands up to the job well.

Finally, there are the two pulleys, one 1 in. in diameter, and the other ½ in. diameter; these I made of duralumin and the drive is by a rubber belt.

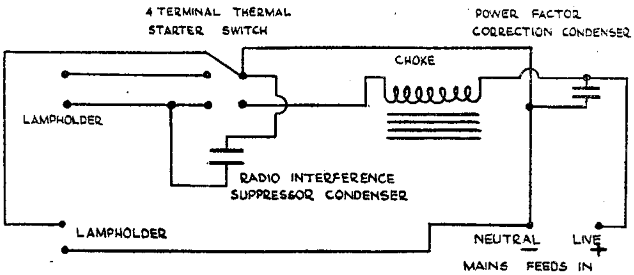
Editor's Correspondence

Fluorescent Lighting

DEAR SIR,—Having read the article in THE MODEL ENGINEER, dated May 15th, "Fluorescent Lighting in the Workshop," which we found very interesting, we should like to point out an error made by "H.C.W." He stated that the smallest fluorescent tube on the present-day British market was a 4 ft. 40 W. This is not so, as Messrs. Scemco Ltd., of Scemco House, 6-7, Soho Street, offer a 30 W. 36 in. fitting of good quality. They also offered, in August, 1946, an 18-in. 15 W. and a 24-in. 25 W. fitting. But how the present supply position is today, we do not know.

Messrs. Brooks & Bohm, of Victoria Street, also offer a 3-ft., 30-watt fitting.

The circuit given, is the circuit that was used in the early days of fluorescent lighting. The latest circuit (reproduced herewith) is more efficient electrically, as well as giving better and easier starting.



We do not write to infer that "H.C.W." is not conversant with the subject, but in the hope of assisting those who might require a smaller fitting or a more efficient circuit.

Yours faithfully,

Northampton J. SMART

DEAR SIR,—I am much indebted to Mr. Smart for the information that lamps of lower power than 40 watts, are available in this country.

The circuit which he gives does not differ fundamentally from that shown in the article. It is designed for a different type of starting switch and has condensers to correct the power factor and suppress radio interference, but these are normally supplied by the manufacturers as part of the equipment.

Yours faithfully,

"H.C.W."

Water Gauges

DEAR SIR,—Recently, in THE MODEL ENGINEER there appeared a reference to water gauges which criticised the design where packing washers are used at each end of the glass instead of glands.

As the design for which I received the award in a competition organised by Messrs. Bassett-Lowke and Stuart Turner embodied this principle, perhaps I may be allowed, in fairness, and for the information of those who may otherwise be misled, to make the following comments:

(*A*) The "end holding" principle was successfully introduced into this country commercially about 45 years ago, and amongst many others the three big Lancashire boilers which supplied power to the works in which I served my apprenticeship were all fitted with such gauges, which for the eight years I was with the firm never gave the slightest trouble and used far fewer glasses than the normal type with radial packed glands. Such gauges are still in use today as I have seen within the last six months.

(*B*) Under any normal conditions any expansion which takes place tends to *increase* the distance between the water-gauge fittings or the abutments of the packing rings, and thus decrease rather than increase any end pressure on the glass.

(*C*) If the packing rings are of suitable material (and a number of such materials are readily available) they will successfully take care of any minute alterations in dimensions in either direction caused by expansion. As they will, and do, do this in full-sized gauges up to 18 in. long, they are extremely unlikely to cause trouble with gauges of less than 1/12th of this length. Furthermore, such packing rings will definitely *not* harden under heat.

(*D*) My colleague, Mr. K. Meyer, who originated (so far as I know) this form of gauge for model work some ten years ago, and myself have between us made and used over two dozen gauges embodying this principle in the period that has elapsed since and neither of us has ever had a broken glass, or a leaky joint.

The foregoing are facts, not mere expressions of opinion, and they speak for themselves.

Yours faithfully,

Harrow. K. N. HARRIS.

Small Screwdrivers

DEAR SIR,—Under "Letters" in the issue of March 27th, Mr. E. Hudson relates difficulties in making satisfactory small screwdrivers. I have had just the troubles he mentions when using drill rod. I found that the best results were obtained by tempering in heated sand with a few extra bits of steel for good measure. One day I tried sharpening up some discarded dentist's burrs, being careful not to draw them. They make the best small screwdrivers I ever had.

Yours faithfully,

New Brunswick, Canada. F. MASSEY.

Re Simple Dark-room Lamp

DEAR SIR,—An alternative to Mr. Granger's wood centrebit is a sharp centrepunch. If tinplate or other light-gauge metal is held in the chuck and the punch used as a parting-off tool, it cuts without tearing or digging in—apparently because of its negative top rake.

Yours faithfully,

Hengoed. F. READ.